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Microcomputer Learning Project
Willow Creek School Division No. 28

Alberta Education

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M I C R O C O M P U T E R

L E A R N I N G

P R O J E C T

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ABSTRACT

The purpose of this study was to conduct a comparative study of the effectiveness of utilizing microcomputers for the development of computer awareness and literacy, and implementation of curriculum courseware with gifted and average upper elementary and junior high school students. The treatment group consisted of gifted and average students from the Willow Creek School Division No. 28 and the comparison group involved a school division of comparable size.

The research incorporated a Non Equivalent Control Group Pre-Test/ Post-Test design. Analysis of Variance was undertaken to determine significance of differences between gain score means. Qualitative analysis involved use of questionnaires, focused interviews, and data gathered by external project evaluators.

Objective results showed that significant differences in average gains were obtained in the following areas:

1. The treatment group (gifted and regular project students) significantly gained more than the comparison group on all the sub-tests of the Test of Divergent Thinking.

2. There were no differences between treatment and comparison groups on the gains measured by the Self Observation Scale.

3. The treatment group gained significantly more than the comparison group on the reading comprehension sub-test of the Canadian Test of Basic Skills.

Subjective results indicated that:

1. The Computer Literacy Questionnaire showed major trends towards enhanced computer literacy for both groups. Differences between treatment and comparison students were relatively minor and centered on computer comfort, ease of use, and feelings of ability.

2. Teacher in-service programs were judged to be relatively successful, especially in the area of computer awareness. Programming was cited by teacher respondents as an area requiring further in-service with greater opportunities for "hands-on" practice.

3. Principals involved in the Project noted some positive effects in terms of other computer-related projects undertaken independently by students involved in the study.

4. Gifted students expressed a greater degree of satisfaction than regular students with graphics, programming, and C.A.I.

5. Teachers indicated that gifted students possessed a greater ability than regular students to retain, extend, and apply concepts in terms of computer literacy.

6. External evaluators identified some of the limitations and benefits of the study.

These results are discussed in relation to recommendations for school jurisdictions implementing computer literacy, courseware and programming.

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CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction and Review of Relevant Literature

The significant impact of computers on society was brought into sharp focus when Time magazine named the computer as "Man of the Year" for 1982. The rationale cited for this recognition was that the computer, as a process, is changing the course of all other processes in the North American office, school and home.

Futurists such as Toffler (1980) and Naisbitt (1982) have suggested that a shift has taken place from an industrial society to an information society. Naisbitt (1982) has estimated that by 1985, 75 percent of all jobs will involve some knowledge of computers.

Mathieson (1982) has suggested that students like the microcomputer for the following reasons:

1. Gives them a sense of control.
2. Allows active learning.
3. Demands interaction.
4. Allows the user to stop and start in the learning task when ready and motivated.
5. Gives immediate feedback.
6. Provides a sense of mastery.
7. Is friendly, patient, and never gives detentions.

In Mindstorms, Papert (1980) states that children, particularly the gifted, should be taught to program the computer at a young age so

that they can build their own environment and develop the skills to help shape the future. In addition, Sisk (1978), a noted authority on gifted children, has discussed microcomputers as a new way for gifted children to express their ideas and allow for an in-depth learning experience at a rapid pace. Gifted students, because of certain characteristics, have a natural affinity for microcomputers. The characteristics of gifted students, such as unusual alertness, curiosity and prolonged attention span, lend themselves adroitly to the challenge and pleasure of programming and understanding the myriad functions of the microcomputer. Doorly (1980) indicated that gifted students have the potential to become the problem-solvers of the future and the microcomputer is rapidly becoming essential in the problem-solving process.

Little research has been conducted with gifted and talented students in relation to facility and expertise in using computers to further learning (Psychology Today, 1984).

Katz (1983) has developed a model for microcomputer education for gifted and talented students. It involves three levels, namely, computer awareness, computer literacy and computer programming.

The presence of microcomputers in schools makes certain forms of C.A.I. practicable and is producing an increasing interest among teachers in the use of computers for instructional purposes.

At the present time, most microcomputers are programmed by teachers and graduate students for use with children with special needs (handicapped, disadvantaged, rural, English as a second language), with adult students, and with students studying topics for which simulations are appropriate.

Within the last few years, microcomputers have been coming into schools at a rapidly accelerating rate; however, it must be mentioned that computers have been primarily utilized with gaming programs and some computer literacy. These programs and others are not directly relevant to the school curriculum. Personal correspondence with leaders such as Dr. S. Hunka, Dr. J. Khatena and Ms. A. Bartelt in the field of education for the gifted indicates the lack of any hard research in the area of the use of microcomputers with the gifted. Psychology Today (1984) devoted an entire issue to computer education and school work. There is no research reported in this issue on gifted and talented students in relation to the use of computers to facilitate their learning. Molnar (1978) indicated that there is a need for some school jurisdictions to be a lighthouse or a leader in teaching computer literacy and computer applications to teachers.

It has been the intention of the Willow Creek School Division No. 28 to expand the existing programs for the gifted into the junior high school and to initiate new programming with average students involving microcomputers. The use of microcomputers and the implementation of curriculum-based courseware for computer-assisted instruction in the areas of mathematics and language arts was felt to be potentially an excellent mode to extend gifted students and possibly to extend average students. It was hoped that the use of microcomputers would introduce new flexibility to instruction, serving each student--gifted, talented, average or handicapped. They assist instruction. More importantly, they are preparing students for the real-life future where computer awareness and literacy will be as necessary as reading.

The Willow Creek School Division No. 28 has had a program of enrichment for gifted children since September 1978. It was initially funded by the Planning and Research Branch of Alberta Education. The project, entitled Gifted Children, by Millar, was published in 1980.

A review of projects involving computer use is summarized in Media and Curriculum (1980). None of the projects related to the comparative use of microcomputers and the implementation of curriculum courseware by gifted and average upper elementary and junior high school students (i.e., Grades 6 - 9).

1.2 General Statement of the Problem

The principal investigators have conducted a comparative exploratory study of the effectiveness of utilizing microcomputers for the development of computer awareness and literacy and of the implementation of curriculum courseware with gifted and average upper elementary and junior high school students.

1.3 General Goals of the Project

WHY COMPUTER ASSISTED INSTRUCTION FOR PARTICIPATING STUDENTS?

1. Computer assisted instruction (C.A.I.) would provide an opportunity for the development of computer awareness and literacy for both teachers and students.

2. In the absence of substantive research, this study attempted to add new information comparing gifted and regular students in acquiring competencies in computer literacy and programming.

3. The implementation of curriculum based courseware under the direction of professional teaching staff and the teaching of basic principles of microcomputer operations and applications were primary focuses of the study.

4. Computer literacy has applications for post-secondary education and for personal use for gifted and average students (e.g., finance, gaming).

5. It would be expected that teachers would become aware of and competent in the use and applications of microcomputers in the schools.

1.4 Specific Goals of the Project

The microcomputer learning project was designed specifically to:

1. Develop an understanding of basic principles of microcomputer operations and applications with gifted and average students, and with classroom teachers.

2. Acquire and utilize existing commercially developed courseware in the areas of math and language arts to assist gifted and average students in attaining computer literacy.

3. Acquire microcomputers for use by gifted and average students (Grades 6 - 9 inclusive).

1.5 Objectives of Microcomputer Learning Project for Average and Gifted Students

Operational definitions of terms used in this study are found in Appendix A.

The specific goals of the microcomputer learning project for the identified students are as follows:

1. To develop familiarity with computers and their applications in society, including an historical study of computer development.

2. To introduce to the project participants the component parts of a computer and how they function.

3. To introduce problem-solving and simple flow charting.

4. To provide ongoing opportunities for interaction with computers as an instructional tool.

5. To examine, at an introductory level, moral and ethical considerations of computers in our society.

6. To develop a knowledge of BASIC computing language.

7. To implement introductory programming instruction.

8. To make students aware of the societal impact of computer applications.

1.6 Research Questions

The microcomputer learning project was designed to answer the following questions:

1. Has teacher in-service provided during the project resulted in teachers acquiring a working knowledge of computer awareness and applications?

2. What is the comparative knowledge base on a pre- and post-test design regarding computer literacy and applications between the treatment and comparison students?

3. What is the comparative proficiency in acquiring elementary programming skills between the gifted and average students in the project?

4. Will the treatment group perform at a higher level of proficiency on selected standardized test measures than the comparison group?

5. What differences in gain scores on academic measures can be demonstrated between gifted and average project students?

6. What is the comparative time frame required to acquire computer literacy between gifted and regular students?

CHAPTER TWO

METHODOLOGY

2.1 The Sample

One hundred and twenty-one upper elementary and junior high school students (Grades 6 - 9 inclusive) participated in the project of whom 70 (58%) were males and 50 (42%) were females.

Participating students were selected from the Willow Creek School Division No. 28 and the County of Lethbridge No. 26. The student population of the School Division approximates 3,100 and that of the County approximates 3,000. The school jurisdictions are situated in Southern Alberta. The major industries in the area are farming and ranching. Eighty students from the Willow Creek School Division No. 28 were selected as the treatment group to receive instruction in the understanding and application of microcomputers. Forty-two students were selected from schools in the County of Lethbridge No. 26. These students served as the control group and received no direct instruction in the use of microcomputers. This sample reflected a similar geography and school population as the treatment group.

2.2 Procedures for Identification and Selection of Participating Students

The following three-part identification and selection processes were used:

1. Nomination. All students in Grades 6 - 9 inclusive, other than those specifically enrolled in special education programs in both school

TABLE 1

NUMBERS OF GIFTED AND AVERAGE STUDENTS PARTICIPATING IN PROJECT

Grade	Willow Creek		County of Lethbridge	
	Average	Gifted	Average	Gifted
6	10	9	6	6
7	16	16	4	4
8	7	7	7	7
9	8	7	4	3
TOTAL	41	39	21	20

jurisdictions, became potential candidates for the program.

a. Classroom teachers and principals used the Class Summary Sheet (see Appendix B) especially devised for the study to assist in identifying the gifted and talented children.

b. The Renzulli-Hartman Scales for Rating Behavioral Characteristics of Superior Students (Parts I, II, and III) were completed by the teacher for each gifted student nominated.

c. The selection of average students involved use of a table of random numbers (Glass and Stanley, 1970). Students so identified then volunteered to take the program and signed a consent form countersigned by their parents.

2. Screening. An educational psychologist administered the following individual tests with each gifted student nominated in both treatment and control groups:

a. WISC-R (Wechsler Intelligence Scale for Children - Revised) or WAIS (Wechsler Adult Intelligence Scale) for students 17 and older. A full scale score of 125 was established as the minimum criterion for program entrance.

b. Gates-MacGinitie Reading Test. This test was selected and administered to both gifted and average students in both school jurisdictions.

c. See Table 4 for a comparison on intelligence between gifted students in the treatment group (Willow Creek) and comparison group (County of Lethbridge). (p. 26)

2.3 Selection

a. The selection team included each school principal and the Assistant Superintendent (Student Services).

b. Parents received notification of the status of the candidacy of the students in the project. Parental consent was obtained.

c. Minimum selection scores were as follows:

i) WISC-R -- 125.

ii) Gates-MacGinitie -- 90th percentile.

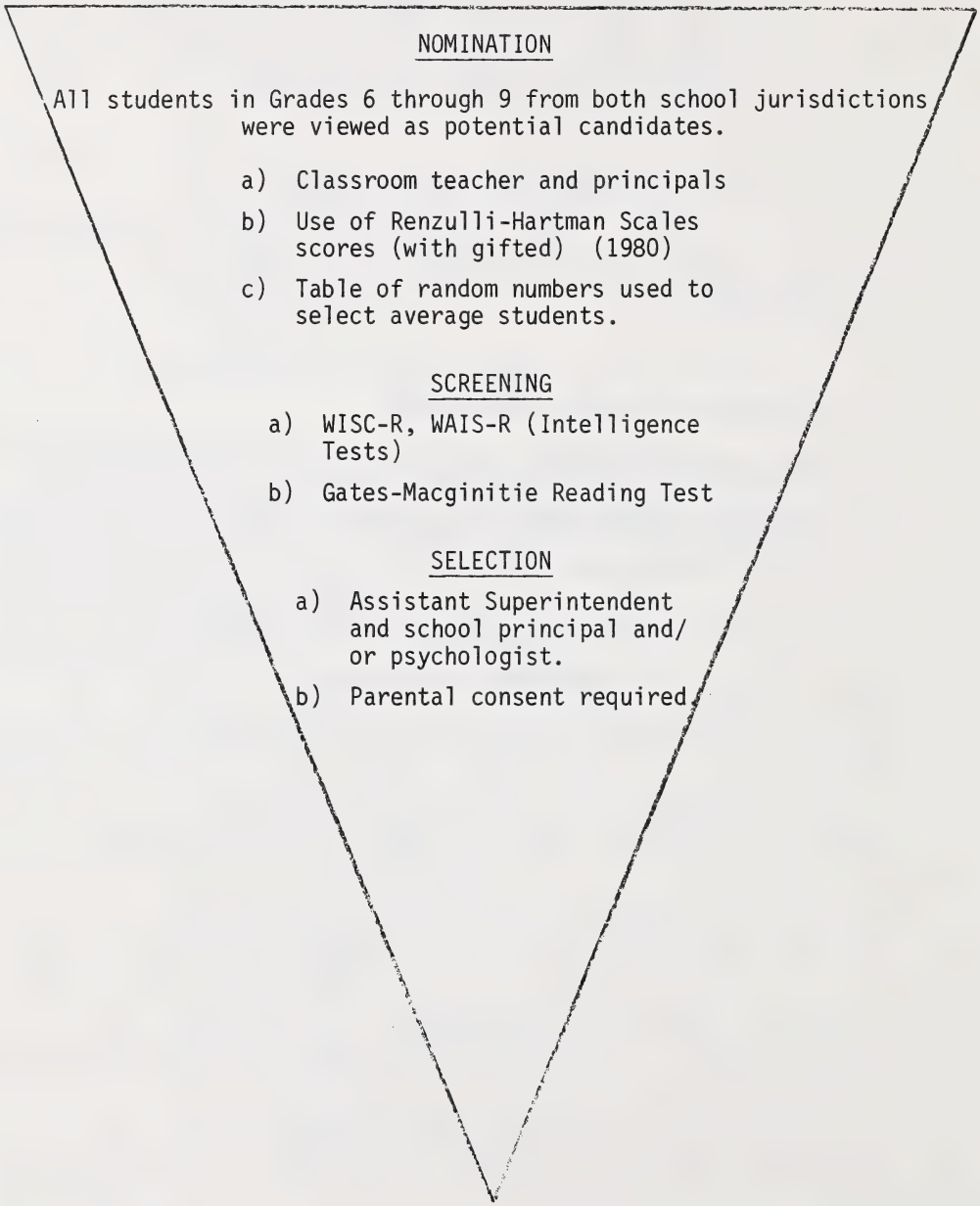
Figure I (Millar, 1980) summarizes the identification and selection processes used.

2.4 Evaluation of Project Objectives

Data gathered from the participating students in both school jurisdictions have been analyzed in an attempt to demonstrate the effects of the program and to answer the research questions. The program involved the use of microcomputers to attain computer awareness and literacy and to implement C.A.I. courseware in the areas of reading and arithmetic skills for average and gifted upper elementary and junior high students in the Willow Creek School Division under the direction of professional staff. The hypotheses implied by the research questions were to be tested in this study. Such hypotheses seek to establish a comparison between average and gifted students in the areas of C.A.I. Specifically, these areas include computer awareness and literacy and courseware implementation. It was expected that significant gains would be made by the treatment group in mathematics, language arts, and positive attitudinal scores when compared to the control (comparison) group.

F I G U R E 1

IDENTIFICATION AND SELECTION PROCEDURES CHART


NOMINATION
All students in Grades 6 through 9 from both school jurisdictions were viewed as potential candidates.
a) Classroom teacher and principals
b) Use of Renzulli-Hartman Scales scores (with gifted) (1980)
c) Table of random numbers used to select average students.
SCREENING
a) WISC-R, WAIS-R (Intelligence Tests)
b) Gates-Macginitie Reading Test
SELECTION
a) Assistant Superintendent and school principal and/ or psychologist.
b) Parental consent required.

2.5 Measuring Instruments

2.5.1 Objective Measures

1. ACADEMIC SCORES

Canadian Tests of Basic Skills (C.T.B.S.) The C.T.B.S. are published by Thomas Nelson (Canada) Limited. The C.T.B.S. battery was first adapted from the Iowa Tests of Basic Skills prior to 1970. The adaptation was made to provide for Canadian content and cultural factors in a battery which had established itself as a good group achievement test battery in the United States.

Following the adaptation, the test battery was normed in a representative standardization sample of Canadian students in 1967. Re-norming occurred in 1974. The Form 4 M Level 9 - 14 (1976) and Form 5 Level 16 (1982) were used in this study. The complete battery of C.T.B.S. takes about four and one-half hours of working time for the students to complete it.

The C.T.B.S. battery consists of tests which provide the following scores: Grade Equivalent, Percentile Rank, and standard scores for students. The following basic and sub-skill areas are tested:

* Vocabulary
* Reading Comprehension

Language Skills . . . a) Spelling
b) Capitalization
c) Punctuation
d) Usage

Work-Study Skills . . a) Map Reading
b) Reading Graphs and Tables
c) Knowledge and Use of Reference Materials

* Mathematics . . . . . a) Concepts
b) Problem-Solving

(*Only the sub-tests marked with an asterisk were used in this study.)

2. SELF CONCEPT MEASURE

Self Observation Scales (S.O.S.) - Junior High Level - Form C. The Junior High Level of the S.O.S. measures seven dimensions of a student's self concept. It is designed for use at grades 7 - 9. Form C was utilized and consists of 72 items. It contains no items related to home or family. Each scale is labelled in a positive manner with high scores being most characteristic of the label. The seven factors of the S.O.S. include self acceptance, self security, social confidence, self assertion, peer affiliation, teacher affiliation, and school affiliation, and are described in Appendix C.

3. COMPUTER LITERACY MEASURE

Computer Literacy Questionnaire (Minnesota Education Computing Consortium). The questionnaire is comprised of two parts; namely, attitudes toward computers and knowledge of computers. See Appendix E for a copy of the actual questionnaire. A codebook and univariate tabulations for this questionnaire are available from the principal investigators.

4. DIVERGENT PRODUCTION MEASURE

Test of Divergent Thinking (Williams, 1980). The Test of Divergent Thinking is a component of the Creativity Assessment Packet (CAP). Other components are a Test of Divergent Feeling and a rating scale for teacher and parent use.

The Test of Divergent Thinking is suitable for boys and girls ages 8 through 18 (grades 3 - 12). The test was group administered.

TABLE 2

TESTS USED ACROSS GROUPS

TESTS	GROUPS			
	STUDENTS		TEACHERS	
	Pre-Test*	Post-Test**	Pre-Test*	Post-Test**
C.T.B.S. (Selected Sub-Tests)	X	X		
S.O.S.	X	X		
Divergent Thinking	X	X	X	X
Computer Literacy	X	X		X

NOTE: * March, 1982
** March, 1984

The Test of Divergent Thinking measures a combination of verbal, left brain abilities along with non-verbal, right brain visual perceptive abilities. It yields scores which include four divergent thinking factors of fluency, flexibility, originality, and elaboration derived from Guilford's extensive factor analytic research on human intellect. See Appendix "D" for an analysis of factors included in the Test of Divergent Thinking.

2.5.2 Qualitative Measures

The qualitative measures employed in the study included the following:

1. External evaluation conducted by an education consultant from the Lethbridge Regional Office. Areas evaluated included implementation procedures, results and efficacy of programs. Evaluations were completed in 1983 and again in 1984.

2. Focused interviews with the participating students (focused attention on a given experience and its effects).

3. Observations recorded and anecdotal records made by teachers and contract person of computer literacy skills and courseware implementation by gifted and average students.

4. Prepared questionnaire and interview by participating principals involving the students involved in the treatment group. See Appendix "F" for a copy of the questionnaire.

TABLE 3

QUALITATIVE MEASURES ADMINISTERED AFTER TWO YEAR PROJECT

March 1984

TREATMENT GROUP: Willow Creek

PROCEDURE	GIFTED	AVERAGE	TEACHERS
External Evaluations (Lethbridge Regional Office and University of Lethbridge - 1983 and 1984)	X	X	X
Focused Interviews	X	X	
Prepared Questionnaires			X

2.6 Research Design

The Nonequivalent Control Goup Design (Design Ten - Campbell and Stanley, 1963) was used in this project. The comparison group was identified from the County of Lethbridge School System. Gifted students in Grades 6 through 9 inclusive were identified and administered the criterion measures. Twenty of these students were identified. In addition, twenty-one average students in Grades 6 through 9 were identified using a table of random numbers and were administered the criterion measures.

2.7 Data Analysis

Much of the analysis of the project was descriptive in nature. Means and standard deviations of pre- and post-test scores were calculated for each of the five sub-scales of the Test of Divergent Thinking (DIV), the seven sub-scales of the Self Observation Scales (SOS), the four sub-scales of the Canadian Test of Basic Skills (CTBS), and for the responses to each of the 97 questions on the Computer Literacy measure. All calculations were made for the total sample of students and, where appropriate, separately for various groups such as the treatment and comparison groups, gifted and regular groups, and for each grade.

Secondly, gain scores were created for each test score. These scores are the simple differences between pre- and post-test scores for those students who wrote both tests. There is some controversy about using a gain score based on a simple difference, as a measure of growth or learning, and some researchers have employed rather elaborate measures of growth, such as the NCE (Normal Curve Equivalent).

However, for the purposes of this project, since the students remained with their same groups for the duration of the study, the gain score would appear to be an adequate and appropriate measure of the students' growth relative to their respective groups. Nevertheless, it must be made clear that for the SOS the scores provided were percentiles, and for the Test of Divergent Thinking, raw scores were used. Grade-equivalent scores were used for Grades 7 to 9 on CTBS, on the advice of Peter Cameron, Manager of the Measurement and Guidance Department of Nelson (Canada), but it was necessary to do a conversion to a standardized measure on the Grade 10 scores. Because Level 14 of the test was administered as the pre-test, and because this version is appropriate only up to Grade 9, it was expected that there might be ceiling effects if this same version were used as the post-test when the students were in Grade 10. Therefore the Level 15 of the test was administered for the post-test and a three-step conversion process was applied to the scores to make them comparable. Also, since Level 15 results in only one score for each of math and reading sub-tests, rather than the two scores for each which had resulted from the pre-test, pre-test standard scores were averaged, resulting in only two measures for the Grade 10 students - one reading and one math.

The final step in the data analysis was to employ three and four way analysis of variance procedures to determine whether the groups differed significantly among themselves; that is, to determine whether there were differences between the treatment and comparison groups, between the gifted and regular groups, among the four grades, and/or between males and females, on the various criterion variables (gain scores). In all cases Alpha levels .05 were considered to be

significant. The data were analyzed using the SPSS Package (Nie, Hull, Jenkins, Steinbrenner and Bent; 1975) on the University of Lethbridge DEC-20 computing system.

2.8 Procedures of Implementation: Procedures Used to Implement Microcomputer Learning Project for Gifted and Average Upper Elementary and Junior High Students.

1. Identification of gifted and average students (February through March 1982). During this two month period, students at the upper elementary and junior high school were identified, tested and selected as the target population for the proposed program. Thirty-nine students in Grades 6 - 9 inclusive qualified according to the criteria established. These criteria are represented in Figure 1, "Identification and Selection Procedure Chart", p. 12.

Forty-one average students were chosen using random numbers and consent of student and parents. The comparison group of students were also identified during this time period.

2. Selection and installation of microcomputers in all participating upper elementary and junior high schools within the Willow Creek School Division No. 28 occurred during the period of February to April of 1982. The Willow Creek School Division No. 28 provided the hardware with the assistance of a grant from the Planning Services Branch. The microcomputers purchased were the Bell and Howell edition of the Apple II+. A minimum of two were placed in each of the seven participating schools.

3. In-servicing of the school based personnel. An extensive series of meetings were conducted with each participating staff member from upper elementary and junior high school. This in-service procedure continued throughout the school year utilizing both after-school time and professional development/Teacher Institute day(s). The purpose of the in-service days was to develop an awareness and instill a basic understanding of principles of computer programming with emphasis on computer assisted instruction in schools. The contract personnel conducted a portion of the in-service activities and additionally some workshops were conducted by personnel from Alberta universities and field personnel. It was anticipated that two teachers, one representing mathematics and one representing language arts, from each school would participate in the workshops. Elementary workshops were held during the course of the project. Appendix G contains a listing of in-service activities conducted for Project participants. It was the intent that the instructional time would be held as constant as possible for both teachers and students.

4. Time for students to interact with microcomputers. At the junior high level, students were enrolled in a "B" option class entitled "Application of Microcomputers". Students in Grade 6 participated in a specially designed course. Time allocation totalled eighty minutes per week in all schools for both instruction and application of concepts and program.

5. Use was made of commercially developed courseware in the areas of mathematics and language arts for computer literacy for both students and professional staff. A listing of courseware used in the study is included in Appendix H.

6. Project resource materials that were found to be useful aids in the study are as follows:

"Computer Tutor". The "Computer Tutor", written by Markle (1980), is designed to help acquaint students with computers--with the way they work and the language they use. It includes information about the importance of computers, what they can and cannot do, how they were developed, how they work, how to design and develop a program, and how to operate a computer. In addition, this book contains (1) a specific set of learning objectives, (2) display and bulletin board ideas, (3) lists of additional information sources, (4) extended learning suggestions for class study of computers, and (5) answers to the many questions and puzzles. While the activities described within the book provide excellent "hands-on" computer learning experiences, they can be done equally well with pencil and paper.

"Computeronics". A Course in Computer Literacy: Programming Skills, Problem Solving and Perspective. "Computeronics", written by Cramer (1978), helps students learn about computers and how to use them. One mini-course involves computer history and uses. A second mini-course includes teacher computer technology and programming in BASIC. It also allows students to use the computer as a problem-solving tool.

"Computer Literacy Program". This publication was obtained from L. Regner, Vice Principal of Greffen Park School in Brooks. The material in this publication provided elementary computer information to teachers.

"Computers Don't Byte" (1981). This manual provided an alternate starting point for teachers using computers.

"Microcomputer Bulletin". In the early stages of the project, microcomputer bulletins were issued to all teacher participants involved in the study to facilitate communication between the principal investigators and the instructional staff. See Appendix I for sample.

7. Research design and evaluation personnel assisted in the planning and monitoring of the research design and performed the necessary statistical analyses on the data collected.

2.9 Study Limitations

No information was collected prior to the data analysis about the students' backgrounds in computing. For example, it was not known whether any of the treatment group had a computer at home, or had had previous experience with computers. Nor was any information available about the comparison group, or about the teachers involved in the study. It is entirely possible that these factors could have had a considerable effect on the results of the study.

The testing procedures were not always uniform. Also, in the Computer Literacy test, for example, a few of the tests were collated improperly, so students may have been thinking of the wrong directions as they answered some questions. In addition, two psychologists were involved in the pre-testing; hence, some differences in the results may have resulted.

Common curriculum content and textual materials exist within the Willow Creek School Division. However, there is no assurance that curriculum materials within the control group (County of Lethbridge) corresponded with the treatment group.

There is no means of controlling teaching methodologies from school to school or between treatment and control groups.

Minor time variations for students in the project occurred during the first year. However, when this became evident, instructional times were standardized for the second year.

It may be that the project did not give the gifted and talented students an opportunity to blossom and apply their abilities.

CHAPTER THREE

RESULTS

3.1 Descriptive Statistics

Descriptive statistics for all students involved in the project are available for Self Observation Scales, Test of Divergent Thinking, and the Canadian Test of Basic Skills. Statistics have been broken out for ease of reference by: groups (treatment and comparison); status (gifted and regular), and by grade level. These data are located in tables contained in Appendix J.

Table 4 provides a comparative description of pretest means of intelligence for gifted students from treatment and comparison groups. The results indicate that no significant differences existed between groups. Therefore equivalent groups were established with respect to I.Q.

3.2 Analysis of Variance (ANOVA) Results

The results of the analyses of variance are shown in Tables 5, 6, and 7. For each of the sub-scales on the three standardized tests, a 4-way ANOVA was performed using each gain score as the dependent variable. The independent variables were:

1. group - treatment and comparison.
2. status - gifted and regular.
3. sex - male and female.
4. grade - 7, 8, 9, 10.

TABLE 4

RESULTS OF T-TESTS TO COMPARE PRE-TREATMENT I.Q.* SCORES FOR WILLOW CREEK AND COUNTY OF LETHBRIDGE GIFTED GROUPS

GRADE	WILLOW CREEK			COUNTY OF LETHBRIDGE			+ PROBABILITY
	N	MEAN	STANDARD DEVIATION	N	MEAN	STANDARD DEVIATION	
Total Grades	39	131.67	6.85	22	130.14	5.74	NS
Grade 5	11	133.18	8.26	6	131.00	8.25	NS
Grade 6	14	133.14	7.42	5	130.80	4.97	NS
Grade 7	7	131.57	3.95	6	129.83	5.34	NS
Grade 8	7	126.43	2.76	5	128.80	4.87	NS

*WISC-R

SIGNIFICANT RESULTS FROM 4-WAY ANALYSIS OF VARIANCE ON TEST OF DIVERGENT THINKING GAIN SCORES WITH GROUP, STATUS, SEX, AND GRADE AS INDEPENDENT VARIABLES

(Total N = 107)

SUB-TEST	VARIABLES	F	df	SIG.	MEANS
1. Fluency	Group	11.807	1	.001	Trt = 2.25 Comp = - .22
	Grade	10.423	3	.000	7 = 2.79 8 = 2.73 9 = - .82 10 = - .19
	Group, Sex	5.010	1	.028	
	Group, Grade	2.905	3	.040	
2. Flexibility	Group, Sex	4.025	1	.048	
3. Originality	Grade	5.646	3	.001	7 = 6.69 8 = 6.60 9 = -1.00 10 = 2.19
4. Elaboration	Group	4.847	1	.031	Trt = 2.49 Comp = .22
5. Title	Group	7.854	1	.006	Trt = 4.31 Comp = - .78
	Grade	5.821	3	.001	7 = 3.79 8 = 6.05 9 = -1.32 10 = - .69
	Group, Grade	3.437	3	.021	

* NOTE. Group = Project students (Gifted and Regular) vs. Comparison students (no treatment)
Status (Regular vs. Gifted students) - None of the differences in gain scores were statistically significant.

TABLE 6

SIGNIFICANT RESULTS FROM 4-WAY ANALYSIS OF VARIANCE ON SOS GAIN SCORES
WITH GROUP, STATUS, SEX, AND GRADE AS INDEPENDENT VARIABLES
(Total N = 112)

SUB-TEST	VARIABLE	F	df	SIG.	MEANS
1. Self-acceptance	NONE SIGNIFICANT				
2. Self-security	Grade	2.755	3	.048	7 = -15.17 8 = 2.46 9 = 10.96 10 = - .94
	Status, Sex, Grade	3.235	3	.026	
3. Social confidence	Status	6.330	1	.014	Gift. = 9.21 Reg. = .02
	Sex, Grade	3.282	3	.025	
4. Self-assertion	NONE SIGNIFICANT				
5. Peer affiliation	Status	5.439	1	.022	Gift. = 3.14 Reg. = - 9.54
6. Teacher affiliation	Grade	3.421	3	.021	7 = -13.48 8 = - 9.97 9 = - .29 10 = 3.06
	Group, Status, Sex, Grade	9.194	1	.003	
7. School affiliation	Sex, Grade	2.786	3	.046	
	Group, Status, Sex, Grade	4.121	1	.046	

SIGNIFICANT RESULTS FROM 4-WAY ANALYSIS OF VARIANCE ON CTBS GAIN SCORES
WITH GROUP, STATUS, SEX, AND GRADE AS INDEPENDENT VARIABLES
(Total N = 95)

SUB-TEST	VARIABLE	F	df	SIG.	MEANS
1. Vocabulary	Grade	14.7000	2	.000	7 = 1.08 8 = 1.61 9 = .81
	Grade, Sex	3.155	2	.049	
	Grade, Sex, Group	3.435	2	.038	
2. Reading Comprehension	Group	6.117	1	.016	Trt = 1.38 Comp = .90
	Group, Sex	4.318	1	.041	
	Group, Grade	5.030	2	.009	
	Group, Sex, Grade, Status	5.389	1	.023	
3. Math Concepts	Grade	4.077	2	.021	7 = 1.81 8 = 2.00 9 = 1.50
	Grade, Status	7.264	2	.001	
	Group, Status, Sex	5.307	1	.024	
	Group, Status, Grade	6.961	2	.002	
4. Math Problems	NONE SIGNIFICANT				
5. Math (Concepts and Problems) Grade 10 - (N = 17)	Status, Sex	5.85	1	.036	

The one exception was the CTBS, for which the Grade 10 sample was analyzed separately; thus, a 3-way ANOVA was performed for the two CTBS sub-scales for Grade 10.

Only the significant results are shown in Tables 5, 6, and 7. The complete ANOVA tables are available from the authors. Since a large number of ANOVAs were conducted, these results should be interpreted with some caution.

3.3 Test of Divergent Thinking

It appears that there was a difference between treatment and comparison groups with respect to divergent thinking. The F value for groups was significant for three of the five divergent thinking scales --fluency, elaboration, and title.

In each case the mean gain scores for the treatment group were higher than for the comparison group. In addition, the gain scores of three of the five sub-scales--fluency, originality and title--differed significantly by grade. In all three of those sub-scales the Grade 7 and 8 students' scores increased considerably more than did the Grade 9 and 10 students' scores.

Interactions between treatment group and grade were significant for the fluency and title gain scores, and interaction between treatment groups and sex were significant for the fluency and flexibility gain scores.

3.4 Self Observation Scales

The computer project appears to have had very little effect on the characteristics measured by the SOS.

There was no difference between the treatment and comparison groups for any of the seven sub-test gain scores. There were significant differences in the mean gain scores of the gifted and regular groups for two of the seven sub-tests (social confidence and peer affiliation); in both cases the gifted group gain scores were higher. There were also significant differences among the four grades in the mean gain scores of the self-security and teacher affiliation sub-tests; however, these differences were not consistent and are difficult to interpret.

3.5 Canadian Test of Basic Skills

The mean gain scores of the treatment group differed significantly from those of the comparison group for only one of the four CTBS measures - reading comprehension. For that sub-test the treatment group's gain score was significantly higher. There were significant differences among the three grades for the vocabulary score and the math concepts score; the gain scores for the Grade 8 students were somewhat higher. In addition, several of the interaction effects were significant. For the Grade 10 sample, which had to be analyzed separately, none of the main effects were significant. However, for Grade 10 math, significant interaction effects were noted when status (regular vs. gifted) and sex were considered jointly. The results indicated that the treatment group gained significantly more than the comparison group.

In response to the research question, What differences in gain scores on academic measures can be demonstrated between gifted and average project students?, an analysis of variance was performed including the factors of grade, sex, group, and status. Of particular interest are the significant results obtained with status as an independent variable. Non-significant results were obtained for language arts areas of vocabulary and reading comprehension. However, significant results were obtained for the attainment of mathematical concepts as measured by the Canadian Test of Basic Skills. These results favoured the gifted project group.

3.6 Results of Computer Literacy Questionnaire

For purposes of analysis, Part I of the Computer Literacy Questionnaire was divided into three components. The descriptive statements in Part I were recorded so that "1" indicated a most negative feeling toward computers and "4" a most positive feeling.

The first component included the first thirty questions which relate to attitudes toward the computer and its use. The second component encompassing questions 31-40 referred to values a person holds toward the computer. The third component, questions 41-48, included descriptive statements reflecting a positive or negative feeling toward computers. Means and standard deviations of the treatment and comparison students' responses in a pre- and post-test design were computed for groups, sex, and status. These results are found in Tables J, K, and L in Appendix K.

It must be noted that the questionnaire used in the project was an experimental edition. Subsequent to the commencement of the project,

a final edition was published which rectified many of the problems cited. The data obtained is not conducive to detailed statistical analysis.

3.6.1 Trends in Data

Part I of Computer Literacy Questionnaire

The reader is cautioned to examine each item in terms of the context of the question. For example, question number 3 expresses a feeling of helplessness around a computer. A more computer literate person would strongly disagree with this statement. Whereas, question number 7 states, "I enjoy using computers in my class." The anticipated answer for a computer literate person would be to agree strongly with the item. The directionality of means does not by itself indicate a growth toward computer literacy.

Part I of the Computer Literacy Questionnaire asks the students to indicate their opinions, values, and attitudes regarding computers. There did not generally appear to be major differences between the treatment and comparison groups. However, there were some trends in that data that are noteworthy:

1. The first fifteen questions which dealt with computer comfort, ease of use, and feelings of ability regarding computer use favoured the treatment group marginally.

2. Questions 16-20 related to male-female use of computers. Very little difference was demonstrated between treatment and comparison groups. However, in the treatment group, females agreed more strongly with the questions supporting female competencies in the use of computers.

3. There was very little change in treatment and comparison groups in responses to questions 21-25 which dealt with computer use in society.

4. Questions 26-30 refer to computer use in schools. The differences between groups are not of sufficient magnitude to justify the drawing of any definitive conclusions.

5. There appears to be no measurable change in either the treatment or the comparison groups regarding questions 30-40 which dealt with personal values.

6. Questions 41-48 which describe attributes of computers tended to favour the comparison group over the treatment group. The comparison group rated the attributes more positively. Of the treatment group students, males rated the attributes more positively. No difference was noted between gifted and regular students on the attributes.

Part II of the Computer Literacy Questionnaire

The questions in Part II of the Computer Literacy Questionnaire deal with knowledge about computers.

A complete report of student responses in the treatment and comparison groups is included as Appendix K (Table M). There were few differences between the treatment and comparison groups on this component of the questionnaire. However, there were a few questions where the treatment group's answers changed markedly after instruction in computer use. These results would be extremely difficult to analyze meaningfully using standard statistical testing procedures.

3.7 Qualitative Data Analysis

Subjective data were gathered by questionnaires, interviews, and external evaluations.

Questionnaires were directed to students, teachers, and principals. Interviews involved student perceptions of the program according to a formalized questionnaire format. See Appendix F for a copy of the student questionnaire. External evaluations were conducted at two periods during the project by personnel from the University of Lethbridge and Alberta Education. The results are reported in the following sections 3.8 - 3.12.

3.8 Summary of Post-In-service Questionnaire

Following the completion of the major in-service component of the project, a questionnaire was distributed to teacher participants. Results of the questionnaire indicated that thirteen out of nineteen felt confident in the area of computer awareness while only nine of nineteen staff felt confident regarding basic computer programming. All nineteen particpants felt that a teacher's handbook of basic programming skills would be of assistance in instructing beginning students. In spite of the numerous in-service activities undertaken for project participants, the rating of those involved ranged from 3 to 7 on a 7-point scale where 7 indicates excellent and the mean was 4.4. In recommendations for improvement in in-service activities, sixteen of the nineteen participants cited the need for more "hands-on" time.

3.9 Free Response Questionnaires from Principals

The comments from the principals generally fell into the following categories: general observations, positive aspects of the project, difficulties encountered, and general staff reaction. These comments are summarized in the section of the report which follows.

Summary of Principals' Comments

A. General Observations

One principal commented, "I do think the program has had very positive effects on schools and our communities. As far as the communities go, it increased computer awareness immensely. Parents of students in the course and even of those not in it, came, visited, and asked questions, and a goodly percentage ended up buying some type of a computer."

In general, the parents of the brighter students were more receptive and anxious to get into computers than were the parents of slower or average students. For example, one school reported that out of the ten students enrolled in the special program, six now have personal computers at home and five out of the six belong to the brighter students.

Initially in the project there appeared to be very little difference between the average students and the gifted. However, as the project progressed and as more of the gifted students acquired personal computers, principals began to see marked differences. Gifted students were becoming more adept at programming, more adept at using the printer, and more secure with its general use.

B. Positive Aspects of the Project As Perceived By Principals

1. All students felt privileged to be part of the study.

2. Other students not involved in the program seemed to become aware of the potential benefits of computers.

3. Some students used computer skills to undertake other projects such as in science.

4. Use of the computer has increased typing speed and accuracy. In addition, computer students have become more conscious of spelling words correctly.

C. Difficulties Encountered

1. Principals felt that ideally computers should be purchased on a ratio of two students to one computer.

2. In order for each student to receive the suggested computer time for math and language arts, some timetabling problems occurred. This seemed to get progressively worse with grade level. It was overcome to some extent by allowing these students to leave their regular classrooms anytime they had some free time.

3. A concern was expressed over the time required for pre- and post-testing and the relevancy of the tests selected to computer applications.

4. Lack of typing skills slowed student response time both in inputting programs and in running programs.

5. Selected courseware was not challenging enough, offering only a drill component.

D. General Staff Reaction

One principal stated the following: "Rated as EXCELLENT. The staff met our venture into computers with an enthusiasm and eagerness which surprised me. There is no doubt that much of the success of the program is due to their co-operation." Other principals made similar favourable comments.

3.10 Results of Student Interviews

In order to obtain student reactions to the microcomputer learning project, principals were asked to conduct student interviews based on a predetermined questionnaire format.

In response to the question "What activities did you complete in this program?", the gifted and regular students in the treatment group indicated that they were involved in the following activities: history of programming; initializing a program; elementary programming; and computer assisted instruction in math and language arts.

In response to the research question "What is the comparative time frame required to acquire computer literacy between gifted and average students?", the student interviews indicated a trend in the student responses favouring the gifted group toward a more in-depth knowledge of computer programming and the other components of computer literacy. Both gifted and average groups had obtained general mastery of computer literacy by the end of the project. Neither the student interviews nor principals' interviews with project teachers indicated a measurable difference in the time framework required to attain basic computer literacy. A possible interpretation is that all project students exhibited enthusiasm toward acquiring computer literacy skills which

may have overcome the expected differences between the gifted and average project groups.

In viewing student responses to the question "What did you especially enjoy about the materials in the program?", the gifted students centered their responses on three main areas, namely, C.A.I. use, graphics, and programming. The regular students also rated C.A.I. use, graphics, and programming as enjoyable. However, their responses were fewer in number and less focused. Only the gifted seemed to enjoy the history of computers.

In terms of any dislikes regarding the project, the gifted students expressed a greater dissatisfaction with C.A.I. in math and language arts compared with the average group. Other concerns included lack of organization during the first year and lack of hardware. A few students found the programs to be too difficult.

In response to the question of whether the students participating in the program had developed any projects as a direct result of the program, interesting results were obtained. First, a high percentage of regular students and gifted students indicated that they had undertaken additional projects as a result of their involvement in the project. For example, students indicated that they completed individual projects in the following areas: design of a Lotto 6/49 program; creation of graphics for title pages of school assignments; design of their own games; and numerous other assignments.

At the same time, it should be noted that almost twice as many gifted students as opposed to regular students indicated that they did undertake specific projects as a result of involvement in the research.

The final two questions asked to participants were:

1. During the project have you or your parents purchased a computer for home use?
2. If yes, was the purchase a result of your participation in the project?

The results of the two questions are summarized in Table 8.

3.11 Results of Teacher Evaluations of Microcomputer Project

At the conclusion of the project each of the participating teachers was provided with a questionnaire assessing both courseware and several general aspects of the project.

Evaluation of Courseware by Teachers: An examination of teacher evaluations of the Milliken courseware and the M.E.C.C. courseware in math and language arts indicated a clear preference for the Milliken materials. However, ease of utilization was more highly related than appropriateness or general use in both Milliken and M.E.C.C.

In response to the question of how participation in the project has facilitated academic achievement in the two selected subject areas of math and language arts, teachers generally responded negatively, especially for the gifted students. However, the drill component on several disks provided additional reinforcement, especially for the average group.

In response to the question regarding differences between gifted and average students on traits such as interest, creativity and literacy, the teachers had difficulty in identifying common characteristics in terms of either group of students. In terms of literacy, some teachers indicated that the gifted group had greater retention and greater

TABLE 8

COMPUTER PURCHASES BY TREATMENT STUDENTS AS A DIRECT RESULT OF THE PROJECT

	GIFTED	REGULAR
YES	13 (32%)	8 (20%)
NO	20 (49%)	22 (54%)
NO RESPONSE	8 (19%)	9 (26%)
TOTAL	41 (100%)	39 (100%)

ability to extend and apply concepts. Another interesting comment regarding literacy was as follows: "The brighter students tended to investigate, experiment with, and talk about computers more so than the average student. Also the carry-over from the computer classroom to the halls, homes, and into the other classrooms seemed to be at a higher level with this group."

Teacher In-service: Participants in the project were able to obtain in excess of thirty-seven hours of teacher in-service time provided by a variety of internal and external personnel. Nevertheless, several of the teachers indicated that they did not feel that they had sufficient in-service time to instruct students effectively, especially in programming skills. Limited access to the computer hardware and courseware was cited as the major problem area.

Benefits of the Computer Project: A. Teachers generally felt that the project provided an opportunity to enhance skills in curriculum development in the area of computer literacy. It also provided the opportunity to acquire some degree of skill in computer programming.

B. It was felt that the regular students gained an enhanced awareness of computer literacy and a chance to enhance self concept because they were selected for this project. The objective data did confirm this expected result.

C. Gains in programming skills opened up new horizons in creativity for the gifted students.

As students prefer "hands-on" experiences with computers, some teachers commented that the ratio of hardware-to-students should be brought as close as possible to one-to-one.

3.12 External Evaluations of the Project

Prior to the conclusion of the project, two external evaluations were undertaken. The first was completed by Mr. John Gray in the Faculty of Education of the University of Lethbridge, while the second was prepared by Mr. Cal Annis, Education Consultant for Media and Libraries, Alberta Education. An interim report was submitted by both external evaluators at the mid-point in the project. These reports were intended to give improved direction to the project.

Mr. John Gray maintained that the circumstances of the project would be unlikely to yield statistically significant differences favouring gifted treatment project students over the regular treatment students. Four limitations of the study were cited. These included inadequate ratio of hardware to students; inappropriateness of some courseware especially for the gifted students; variation of computer expertise; and difficulties among project teachers encountered in obtaining a standardized amount of class time for project students.

Some of the benefits that were reported included the development of a cadre of "computer knowledgeable" teachers experienced in instructional courseware applications; beneficial "spin-off" uses with handicapped students; and the social benefits for students in that computers provided a social centre for co-operation and mutual assistance in a way that promoted social interaction. More especially, the external evaluation found that "Some students, of a solitary disposition, have acquired a level of expertise that has led them into greatly increased social interaction with fellow students in a consultant capacity."

Mr. Cal Annis indicated in his report that the project has facilitated identification of internal leadership within the computer operations field. Among his recommendations were the following:

¶ The corps of teachers, resource personnel and administrators involved in the project be maintained to serve as a co-ordinating group for the future development of the microcomputer program in the Division.

¶ Policies, guidelines, and procedures be developed to provide structure, direction and expectations for the microcomputer program in the Willow Creek School Division No. 28.

¶ A standard cataloguing selection and control mechanism be established to ensure appropriate acquisition, security and utilization of microcomputer programs and packages.

CHAPTER FOUR

DISCUSSION AND RECOMMENDATIONS

Prior to providing recommendations, this concluding chapter will examine the data in relation to the research questions.

4.1 RESEARCH QUESTION: Has teacher in-service provided during the project resulted in teachers acquiring a working knowledge of computer awareness and applications?

The teacher responses to the post-in-service questionnaire strongly indicated that computer awareness had been achieved in the in-service activities although many staff remained insecure in handling computer programming. In spite of the foregoing, one of the external evaluators concluded that "Initial preparation and on-going training for the project teachers were inadequate for optimum operation of the project." The conclusion was that an inadequate amount of time and insufficient opportunity for hands-on in-service experiences were provided to teachers in this project.

In view of the above it is recommended that:

1.1 Jurisdictions considering implementation of computers and their educational applications should strongly consider a major thrust in prolonged in-service activities centered on knowledge of computers and their applications.

1.2 A major component of teacher in-service activities in order to enhance teacher comfort or ease is time to apply skills with sufficient hardware.

1.3 A school jurisdiction should have available a handbook for teachers for computer awareness and programming. Teachers did not feel that the materials provided by the computer manufacturers were adequate in this regard.

4.2 RESEARCH QUESTION: What is the comparative knowledge base on a pre- and post-test design regarding computer literacy and applications between the treatment and comparison students?

According to the results of the Computer Literacy Questionnaire, in the area of computer comfort, ease of use and feelings of ability the treatment groups scored marginally higher than the comparison group. A possible explanation of this finding is that students within the control group may have purchased computers during the time that the project was underway. Although no formal program of instruction was undertaken for the comparison group, no control existed over private purchases and self-instruction which may have confounded the results.

In the areas of computer use in society and schools and personal values, trends were not firmly established enough to comment.

The questionnaire used was an experimental edition whose validity and reliability are subject to question. In addition, students in the comparison group during the course of normal instruction and daily living were likely to become increasingly aware of computer use in schools and elsewhere.

The second section of the Computer Literacy Questionnaire dealt with knowledge about computers. Questions which dealt with factual content regarding computer operations favoured the treatment group. It was expected that such a result would be obtained after computer instruction.

It is recommended that:

2.1 Schools contemplating the use of a computer literacy questionnaire to establish base-line data prior to a program of computer literacy should seek an instrument that is both valid and reliable. In view of the project results, the investigators do not recommend the questionnaire used in the study.

4.3 RESEARCH QUESTION: What is the comparative proficiency in acquiring elementary programming skills between the gifted and average students in the project?

Results of project student interviews indicated that gifted students had considerably greater interest in the programming area. In addition, gifted students were much more likely to undertake additional projects than were the regular students. In teacher interviews, it was noted that the gifted students tended to excel in the area of programming.

It is recommended that:

3.1 Jurisdictions which are planning to utilize computers in their programs for gifted students should accord a priority to the area of providing instruction in programming rather than to the area of purchase of pre-written courseware.

4.4 RESEARCH QUESTION: Will the treatment group perform at a higher level of proficiency on selected standardized test measures than the comparison group?

In order to analyze differences in standardized test results between treatment and comparison groups, the research design utilized analysis of variance. The selected standardized tests included the Test of Divergent Thinking, Self Observation Scales, and the Canadian Test of Basic Skills.

The Test of Divergent Thinking indicated that there were significant differences in fluency, flexibility, originality, elaboration and title. Therefore, these differences between treatment and comparison groups may be attributable to some aspect of the microcomputer learning project. The computer project may have contributed to the creativity development of the treatment students.

The Self Observation Scale which is a measure of the individual's self concept did not differ significantly between treatment and comparison group.

The treatment group scored significantly higher than the comparison group on the reading comprehension sub-test of the Canadian Test of Basic Skills. There were no significant differences in gains between groups on the other academic areas measured on the C.T.B.S.

The improved performance in reading comprehension by the treatment group may be due to the C.A.I. courseware that dealt with language arts. However, the overall academic impact of the C.A.I. is difficult to assess given the nonsignificant scores which were obtained in the mathematics area.

It is recommended that:

4.1 In view of the relatively negative teacher evaluation of the commercial C.A.I. used in mathematics and language arts, and considering that a significant difference was found in only one sub-test of the Canadian Test of Basic Skills, school jurisdictions must be cautious with regard to expected gains in student achievement on C.A.I courseware.

4.2 In view of the positive relationship between creativity and computer applications, future study should be undertaken to determine more precisely the nature of this relationship.

4.5 RESEARCH QUESTION: What differences in gain scores on academic measures can be demonstrated between gifted and average project students?

Significant results were obtained for the attainment of mathematics concepts as measured by the Canadian Test of Basic Skills. These results favoured the gifted project student group. However, nonsignificant results were obtained for the language arts areas of vocabulary and reading comprehension. Both students and teacher commented on the poor quality of courseware materials in the area of language arts when no similar concerns were expressed over the quality of mathematical courseware used in the project.

It is recommended that:

5.1 Educators are especially admonished to pay particular attention to the quality of courseware to be purchased.

5.2 Abstractness contained in a subject field appears to be a factor that attracts gifted students to courseware that develops essential concepts, whereas the mechanics of grammar courseware may tend to

alienate bright, creative people.

4.6 RESEARCH QUESTION: What is the comparative time frame required to acquire computer literacy between gifted and regular students?

The principal investigators experienced significant difficulty in addressing the issue raised by this final research question. Utilizing subjective measures they were able to determine in that part of computer literacy which involved introductory programming the gifted students exhibited a clear superiority as reported by principals and teachers.

It is recommended that:

6.1 School jurisdictions incorporate introductory programming where gifted students will be involved.

6.2 School jurisdictions are cautioned against creating unreasonably high expectations in mastering programming skills for regular students who are enrolled in computer literacy courses.

4.7 Additional Recommendations

Evaluators, including teachers, students and external evaluators, made a number of observations that may be useful for school jurisdictions considering implementation of major programs in computer awareness, use of C.A.I., and other applications.

It is recommended that:

7.1 A computer utilization committee be established with representatives from administrators, teachers, and a trustee representative, to co-ordinate purchase of courseware and to ensure a basic standard can be developed throughout a school jurisdiction.

7.2 In implementing in-service activities, student workshops be held in addition to activities specifically planned for professional staff.

7.3 Additional research be undertaken to explore sex differences in attitudes towards computers.

7.4 A study be conducted on the impact of C.A.I. courseware on the underachiever in schools.

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* Letters are in the possession of the Principal Investigators.

APPENDIX A

OPERATIONAL DEFINITIONS OF TERMINOLOGY

APPENDIX A

Operational Definitions of Terminology

BASIC LANGUAGE stands for Beginner's All-Purpose Symbolic Instruction Code. BASIC is a widely used beginner's high level programming language. BASIC is a preferred computer language because it is so much like English.

COMPUTER AWARENESS includes: familiarization with computers (what they can and cannot do); "hands-on" experiences (learning to interact and communicate with computers); learning to use computers for problem-solving; and using computer assisted instruction to a limited degree in carefully selected circumstances, or as part of the "hands-on" experiences. The overall goal of computer awareness is to promote an understanding of computer applications to problems and situations in academic, business, and social arenas. Computer awareness incorporates applications in these fields and assesses the impact upon society of computer technology and applications.

COMPUTER LITERACY is that part of awareness that involves the manipulation of hardware, software, courseware, and problem-solving techniques in order to manage the computer. Computer literacy is a part of computer awareness which may include: manipulative skills (using computer programming); social implications, attitudes and values; and cognitive skills allowing communication with knowledgeable programmers.

INTRODUCTORY PROGRAMMING is that part of literacy that involves the simplest program development, writing and usage.

COMPUTER ASSISTED INSTRUCTION (C.A.I.) refers to the application of computer technology in the areas of drill and practice, tutorial instruction and simulations. Individual needs are met through unique rates of learning based upon established learning theories.

APPENDIX B

CLASS

SUMMARY

SHEET

GIFTED AND TALENTED CHILDREN

Class Summary Sheet

Student's Name	Intel-lectual	Academic (Specify)	Leadership	Creative Thinking	Visual Perform. Art (Specify)	Psycho-motor

Definitions of Talent Areas

Gifted children shall be defined as those children who consistently excel or show the potential to consistently excel above the average in one or more of the following areas of human endeavor to the extent they need and can profit from specially planned educational services:

1. General Intellectual Ability. The child possessing general intellectual ability is consistently superior to that of other children in the school to the extent that he/she needs and can profit from specially planned educational services beyond those normally provided by the standard school program. Typically this ability is measured by an individual administered intelligence test, but it can also be judged by overall academic performance.

2. Specific Academic Aptitude. The child possessing a specific academic aptitude is that child who has an aptitude in a specific subject area that is consistently superior to the aptitudes of other children in the school to the extent that he needs and can profit from specially planned educational services beyond those normally provided by the standard school profram.

3. Creative Thinking. The creative thinking child is that child who consistently engages in divergent thinking that results in unconventional responses to conventional tasks to the extent that he needs and can profit from specially planned educational services beyond those normally provided by the standard school program.

4. Leadership Aiblity. The child possessing leadership ability is that child who not only assumes leadership roles, but also is accepted by others as a leader to the extent that he needs and can profit from specially planned educational services beyond those normally provided by the standard school program. The gifted child may be the initiator of group activities in the classroom, or the playground, or in other social environments.

5. Visual and Performing Arts Ability. The child possessing visual and performing arts ability is that child who, by his consistently outstanding aesthetic production in drama, graphic arts, sculpture, music or dance, needs and can profit from specially planned educational services beyond those normally provided by the standard school program.

6. Psychomotor Ability. The child possessing psychomotor ability is that child who consistently displays mechanical skills or athletic ability so superior to that of other children in the school that he needs and can profit from specially planned educational services beyond those normally provided by the standard school program.

PLEASE RETURN TO YOUR PRINCIPAL BY

GWM/gb

APPENDIX C

SELF CONCEPT

MEASURE

APPENDIX C

SELF-CONCEPT MEASURE

SELF OBSERVATION SCALES (S.O.S.) Junior High Level - Form C

The Junior High Level of the S.O.S. measures seven dimensions of the student's self-concept. It is designed for use in Grades 7 - 9. Form C was utilized and consists of 72 items. It contains no items related to home or family. Each scale is labelled in a positive manner with high scores being most characteristic of the label.

Scale 1 - SELF ACCEPTANCE

Students with high scores view themselves positively and attribute to themselves qualities of basic competence, self satisfaction and happiness. They see themselves as performing well in a number of activities and possessing confidence in their future success. Students with low scores are unsatisfied with their performance and capabilities and are unsure of their futures. Three items highly related to this scale are:

I do a lot of things well.
I think I will be successful in life.
When I look in the mirror, I like what I see.

Scale II - SELF SECURITY

Students with high scores report a high level of emotional confidence or stability. They report being in control of factors affecting their lives and worry very little about either specific or non-specific fears. Students with low scores on this scale worry a great deal. They report nervousness about nonspecific performance expectations and often feel that they worry more now than in the past. Three items highly related to this scale are:

I often find myself worrying about something.
At times I lose sleep over worry.
I worry about losing my friends.

Scale III - SOCIAL CONFIDENCE

Students with high scores on this scale express confidence in their ability to relate in social situations and to make and keep friends. They believe that other people value their friendship. Students with low scores have difficulty making friends and lack confidence in social situations. Three items highly related to this scale are:

People who are like me don't have a good chance to be successful.
Most of my friends don't care what I think.
If people knew what I am really like, they would steer clear of me.

Scale IV - SELF ASSERTION

Students with high scores view themselves as possessing leadership qualities and as being respected by others for possessing these qualities. The emphasis on this scale is on how students believe others view them. Students with low scores see themselves as lacking leadership ability and assertiveness. Three items highly related to this scale are:

Other students look to me for leadership.
Other students look to me for ideas.
In discussions with my friends, my point of view usually wins.

Scale V - PEER AFFILIATION

Students with high scores on this scale consider their relationships with other students to be both of high quality and of considerable importance to them. They see themselves as approved of and valued by their peers. They like to be with other students. Students with low scores do not see their peer relationships as an asset. They view other students as unfriendly, do not accept the responsibilities of friendship easily, and have few friends. Three items highly related to this scale are:

I make friends easily.
Other students are usually fair to me.
I can count on my friends when I am in trouble.

Scale VI - TEACHER AFFILIATION

Students with high scores on this scale like their teachers. They see the teacher as helpful, attentive, understanding, and generous. Students with low scores see the teacher as arbitrary, inconsiderate of children, and/or as a source of emotional pain. Three items highly related to this scale are:

My teachers like to help me.
When I do something wrong, my teachers correct me without hurting my feelings.
My teachers expect too much of me.

Scale VII - SCHOOL AFFILIATION

Students with high scores view school positively, enjoy going to school, and enjoy the activities associated with school. Students scoring low on this scale see school as a hassle that keeps them from doing what they want to do. Three items highly related to this scale are:

I like to stay home from school.
This school is like a jail.
School frequently keeps me from doing what I want to do.

APPENDIX D

SUMMARY OF FACTORS

IN

TEST OF DIVERGENT THINKING

APPENDIX D

SUMMARY OF FACTORS IN TEST OF DIVERGENT THINKING

Five raw scores are obtained. They include Fluency, Flexibility, Originality, Elaboration, and Title. A brief summary of each follows.

FLUENCY: Quantity of production by count of frames attempted regardless of what was done in each.
Rationale: Creative people are productive, hence obtain higher fluency.

FLEXIBILITY: Number of times the picture shifts from category of first frame across the four possible categories listed below:

Living (L) - person, face, flower, tree, animal, etc.

Mechanical (M) - boat, spaceship, bicycle, car, tool, toy, equipment, etc.

Symbol (S) - letter, number, name, something expressing a meaning, etc.

View (V) - city, highway, house, yard, park, etc.

Rationale: Creative people will shift often rather than rigidly hanging on to one way or one category. Not fixed but flexible.

ORIGINALITY: Where person works on drawing.
Each frame has a closed part created by the stimulus line or form shown. This part acts as a restriction to a less creative person. Originality is highest for those who draw in and around the form or restricted part.
Rationale: Less creative people are blocked by the closed portion and will avoid it. More creative people will work inside the closed part and will be structured from outside. Highly creative people will create a synthesis and not be structured nor blocked by any closed portion.

ELABORATION: Where details are placed making picture asymmetrical.

TITLES: Vocabulary skill and creative meaning in titles are scored.

A P P E N D I X E

C O M P U T E R
L I T E R A C Y
Q U E S T I O N N A I R E
(Experimental Edition)

MINNESOTA EDUCATIONAL CONSORTIUM

PART 1

DIRECTIONS: Indicate how much you AGREE or DISAGREE with each of the following statements by circling the appropriate letter. Circle "a" if you STRONGLY DISAGREE with the statement. Circle "b" if you DISAGREE with the statement a little. Circle "c" if you are UNDECIDED about whether you agree or disagree with the statement. Circle "d" if you AGREE with the statement a little. Circle "e" if you STRONGLY AGREE with the statement.

As an example, if you AGREE a little that computers are noisy, then circle "d" as shown below:

Computers are noisy a b c (d) e

Or, if you are UNDECIDED about whether computers are noisy, circle "c" as shown below:

Computers are noisy a b (c) d e

If you have any questions, ask your teacher.

	STRONGLY DISAGREE	DISAGREE	UNDECIDED	AGREE	STRONGLY AGREE
	a	b	c	d	e
1. I would like to learn more about computers...	a	b	c	d	e
2. Working with a computer would probably make me feel uneasy or tense.....	a	b	c	d	e
3. I feel helpless around a computer.....	a	b	c	d	e
4. Computers sometimes scare me.....	a	b	c	d	e
5. I would very much like to have my own computer.....	a	b	c	d	e
6. I would like the idea of taking computer courses.....	a	b	c	d	e
7. I enjoy using computers in my classes.....	a	b	c	d	e
8. Walking through a room filled with computers would make me feel uneasy.....	a	b	c	d	e

	STRONGLY DISAGREE	DISAGREE	UNDECIDED	AGREE	STRONGLY AGREE
	a	b	c	d	e
. I feel uneasy when I am with people who are talking about computers.....	a	b	c	d	e
. I enjoy working with computers.....	a	b	c	d	e
. I feel confident about my ability to use computers.....	a	b	c	d	e
. It is my guess that I am <u>not</u> the kind of person who works well with computers.....	a	b	c	d	e
. On the whole, I can cope with computers in my daily living.....	a	b	c	d	e
. I am able to work with computers as well as most others my age.....	a	b	c	d	e
. Computers are gaining too much control over people's lives.....	a	b	c	d	e
. In general, females can do just as well as males in computer careers.....	a	b	c	d	e
. More females than males have the ability to become computer specialists.....	a	b	c	d	e
. Using computers is more for males than for females.....	a	b	c	d	e
. Studying about computers is just as important for females as for males.....	a	b	c	d	e
. Men make better scientists and engineers than women do.....	a	b	c	d	e
. Falsifying information in computers is a serious crime.....	a	b	c	d	e
. Access to personal information in computer files is a serious problem.....	a	b	c	d	e
. Organizations should <u>not</u> be allowed to create secret computer files containing detailed information regarding people's personal lives.....	a	b	c	d	e
. Because of computerized information files, too many people have information about other people...	a	b	c	d	e

	STRONGLY DISAGREE	DISAGREE	UNDECIDED	AGREE	STRONGLY AGREE
	a	b	c	d	e
25. To protect people's privacy it is necessary to have laws regarding computer files that contain personal data.....	a	b	c	d	e
26. Every secondary school student should have some minimal understanding of computers.....	a	b	c	d	e
27. Every secondary school student should be able to write a simple program.....	a	b	c	d	e
28. Every secondary school student should learn about the role that computers play in our society.....	a	b	c	d	e
29. Computers can be a useful instructional aid in many subject areas other than mathematics.....	a	b	c	d	e
30. Computers provide more disadvantages than advantages in education.....	a	b	c	d	e

DIRECTIONS: Indicate whether you think each of the following values is UNIMPORTANT, IMPORTANT, or EXTREMELY IMPORTANT by circling the appropriate letter. Circle "a" if you think the value is UNIMPORTANT. Circle "b" if you think the value is IMPORTANT. Circle "c" if you think it is EXTREMELY IMPORTANT.

As an example, if you think saving money is EXTREMELY IMPORTANT, circle "c" as shown below:

Saving money a b (c)

	UNIMPORTANT	IMPORTANT	EXTREMELY IMPORTANT
	a	b	c
31. Freedom.....	a	b	c
32. World Peace.....	a	b	c
33. Economic Growth.....	a	b	c

	UNIMPORTANT a	IMPORTANT b	EXTREMELY IMPORTANT c
. Scientific Knowledge.....	a	b	c
. Privacy.....	a	b	c
. Technological Advancement.....	a	b	c
. Computerization.....	a	b	c
. Efficiency.....	a	b	c
. Love and Friendship.....	a	b	c
. Self Respect.....	a	b	c

RECTIONS: Below are some adjectives that can be used to describe computers. r each adjective circle the alternative which best expresses how you feel out computers. If you aren't sure how you feel, circle "undecided." an example, if you feel that computers are very big, then circle as shown re:

a. not big b. big (c. very big) d. undecided

you feel that computers are not big, then circle as shown here:

(a. not big) b. big c. very big d. undecided

rcle one alternative for each of the eight adjectives.

COMPUTERS ARE:

. a. not personal b. personal c. very personal d. undecided

. a. not frustrating b. frustrating c. very frustrating d. undecided

. a. not good b. good c. very good d. undecided

. a. not humanizing b. humanizing c. very humanizing d. undecided

. a. not challenging b. challenging c. very challenging d. undecided

. a. not bad b. bad c. very bad d. undecided

. a. not impersonal b. impersonal c. very impersonal d. undecided

. a. not dehumanizing b. dehumanizing c. very dehumanizing d. undecided

PART II

DIRECTIONS: For each of the following questions, circle the letter beside the best answer. If you do not know the answer to a question, do not leave the item blank; circle the letter beside "I don't know." Use the "I don't know" response as little as possible. Use the "I don't know" response only when you don't have even a guess about the best answer. Do NOT leave any item blank that you attempt; either circle the letter beside an answer or "I don't know."

1. Police sometimes use computers to help identify stolen cars.
   a. true
   b. false
   c. I don't know

2. Most hospitals give injections by computer.
   a. true
   b. false
   c. I don't know

3. Computers cannot be used to assist in teaching English grammar.
   a. true
   b. false
   c. I don't know

4. Computers are not really used very much yet except by scientists.
   a. true
   b. false
   c. I don't know

5. Government officials use computers to store and retrieve large amounts of information about citizens.
   a. true
   b. false
   c. I don't know

6. People often use computers to store large amounts of information they wish to use over and over again.
   a. true
   b. false
   c. I don't know

7. Computers help people make decisions by providing correct answers to any question.
   a. true
   b. false
   c. I don't know

8. Computers help people make decisions by telling them if their problem is important.
   a. true
   b. false
   c. I don't know

9. Computers have been used to make information and products available to the consumer.
   a. true
   b. false
   c. I don't know

10. Computers are used to commit crimes, especially stealing money and stealing or falsifying information.
   a. true
   b. false
   c. I don't know

11. Identification numbers and passwords are a primary means for restricting undesired access to computer files.
   a. true
   b. false
   c. I don't know

12. Use of computers in education always results in less personal treatment of students.
   a. true
   b. false
   c. I don't know

13. Privacy is an issue with files containing personal information about people.
   a. true
   b. false
   c. I don't know

14. The increased use of computers in our society both eliminates and creates jobs.
   a. true
   b. false
   c. I don't know

15. Almost all people in our society are affected in some way by computers.
   a. true
   b. false
   c. I don't know

16. In order to use a computer you would have to be in the same building as the computer.
   a. true
   b. false
   c. I don't know

17. Computers are able to think in every way just like people.
   a. true
   b. false
   c. I don't know

18. Using computers can free one to do more creative tasks, but this may lead to more dependence upon machines.
   a. true
   b. false
   c. I don't know

19. In order to use any computer you would have to use a telephone.
    a. true
    b. false
    c. I don't know

20. In order to use a computer a person must know how to program.
    a. true
    b. false
    c. I don't know

21. Computers are not good for tasks that require
    a. speed
    b. accuracy
    c. intuition
    d. something to be done over and over again
    e. I don't know

22. If your charge bill has an error, it was probably caused by:
    a. breakdown of the computer
    b. mistakes made by people
    c. poor design of the computer
    d. general weaknesses of machines
    e. I don't know

23. The main duty of a computer programmer is to:
    a. operate a computer
    b. prepare instructions for a computer
    c. schedule jobs for a computer
    d. design computers
    e. I don't know

24. The computer related job closest to that of a typist is:
    a. computer operator
    b. keypunch operator
    c. systems analyst
    d. computer programmer
    e. I don't know

25. Which of the following persons is the most likely to be associated with the design of computers?
    a. keypunch operator
    b. computer operator
    c. computer programmer
    d. computer scientist
    e. I don't know

26. A basic use of computers in libraries involves:
    a. information storage and retrieval
    b. simulation and modelling
    c. process control
    d. computation
    e. I don't know

27. A basic use for computers in the design of airplanes is:
    a. simulation and modelling
    b. process control
    c. making reservations
    d. keeping inventory
    e. I don't know

28. The most questionable use of large computer files is:
    a. government planning
    b. research
    c. checking on people
    d. administration of social programs
    e. I don't know

29. Which of the following is a limiting consideration for using computers?
    a. cost
    b. software availability
    c. storage capacity
    d. all of the above
    e. I don't know

30. Which is not characteristic of most information systems?
    a. a large volume of information is stored and used
    b. the information is organized
    c. the basic purpose is to provide reports and summaries of the data
    d. they contain only alphabetic data
    e. I don't know

31. The decade of first extensive manufacturing of computers was:
    a. 1860's
    b. 1890's
    c. 1920's
    d. 1950's
    e. I don't know

32. Computer software is a term describing:
    a. computer programs
    b. electronic components encased in soft plastic or rubber
    c. people who work with computers
    d. mechanical and electronic parts of a computer system
    e. I don't know

33. In addition to input and output equipment, computers contain:
    a. terminals, paper, transistors
    b. memory units, control units, arithmetic units
    c. printers and typewriters
    d. telephones, keyboards, television screens
    e. I don't know

34. A computer system is best described as:
    a. processing
    b. programming, input and output
    c. input and output
    d. input, processing and output
    e. I don't know

35. The physical parts of a computer are referred to as:
    a. programs
    b. hardware
    c. software
    d. manuals
    e. I don't know

36. When in operation, a computer:
    a. follows a set of instructions written by people
    b. thinks just like a person
    c. recalls answers from memory
    d. translates data from digital to analog code
    e. I don't know

37. Computers cannot run without:
    a. blinking lights
    b. keyboards
    c. instructions
    d. all of the above
    e. I don't know

38. In order to program a computer a person:
    a. can use any English language words
    b. can use any English or foreign language words
    c. must use programming language numbers, not words
    d. must use the words from a programming language
    e. I don't know

39. At any given moment, a computer's memory unit can store:
    a. programs
    b. data
    c. answers
    d. all of the above
    e. I don't know

40. Data processing is best described as:
    a. the collection of data
    b. producing reports
    c. manipulating data according to instructions
    d. using punched cards in a keypunch machine
    e. I don't know

41. A computer program is a:
    a. course on computers
    b. set of instructions to control the computer
    c. computer generated presentation
    d. piece of computer hardware
    e. I don't know

42. Computer processing of data may involve:
    a. searching
    b. summarizing
    c. deleting
    d. all of the above
    e. I don't know

43. The computer must have two types of information to solve the problem:
    a. the problem and the answer
    b. the name of the program and user number
    c. the data and the instructions
    d. the name of the program and your name
    e. I don't know

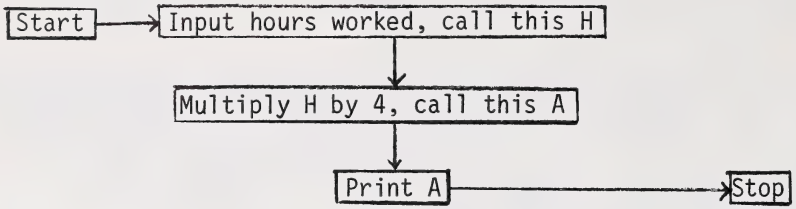
44. A newspaper publisher has the following information about subscribers stored in the computer. They are name, address, and renewal date. How would you arrange the information to be most useful to the delivery person?
    a. ordered listing by address
    b. ordered listing by renewal dates
    c. alphabetical listing of streets
    d. ordered listing by zip code
    e. I don't know

45. Choose the corrected output for the procedures described below:
    1. list the three names Brown, Anderson and Crane in alphabetical order
    2. remove the last name from the list
    3. if only one name is left, stop. Otherwise, go on to step 4.
    4. list the remaining names in reverse order
    5. go back to step 2

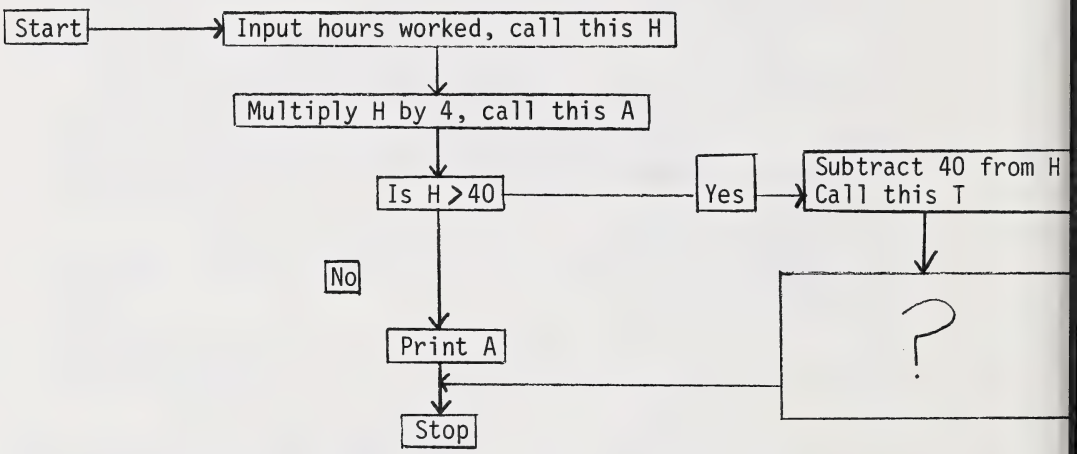
    Output

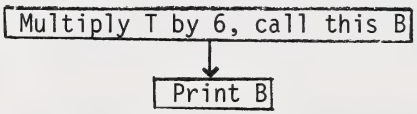
    a. Anderson, Brown, Crane
    b. Brown
    c. Anderson, Brown
    d. Anderson
    e. None of these

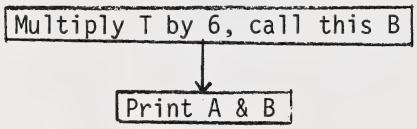
46. An algorithm (flowchart) to determine the weekly wages of employees in a bakery is shown below. Employees are paid $4 per hour up to 40 hours per week.

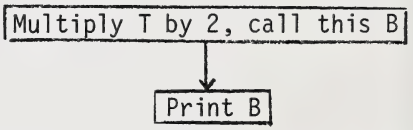


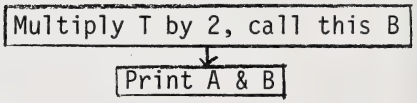
Employees are also paid "time-and-a-half" ($6 per hour) for overtime (hours worked over 40). How would you extend the flowchart below to include overtime pay. Select answer a, b, c, d, or e.



a. 

b. 

c. 

d. 

e. I don't know

DIRECTIONS: If you have never written a computer program, STOP: Do NOT answer items 1 - 3 below. Answer items 1 - 3 only if you have written a computer program before.

1. Choose the correct output for the computer program shown below:

```
1    LET A = 3
2    LET B = 4
3    LET C = A
4    LET B = C
5    LET A = B
6    PRINT A, B
7    END
```

Output

a. 3 4
b. 4 3
c. 3 3
d. 4 4
e. I don't know

2. When run on a computer, the following program will:

```
1    INPUT A, B, C, D, E
2    LET S = A+B+C+D+E
3    LET M = S/5
4    PRINT S,M
5    END
```

a. Calculate the sum of five input values
b. Calculate the average of five input values
c. Print the sum and average of five input values
d. all of the above
e. I don't know

3. This program instructs the computer to count by two.

```
10    LET M = 0
20    LET M = M + 2
30    PRINT M
40    IF M<100 THEN 20
50    END
```

Which change will produce a program which can be used to count by A? (For example, A=3, 5, or 8.)

a.
```
5 READ 1
7 DATA 3,5,8
```

b.
```
5 LET M = A
30 PRINT A
```

c.
```
5 INPUT A
20 LET M = M + A
```

d.
```
5 LET X = A
10 LET M = X + A
```

e. I don't know

APPENDIX F

PREPARED

STUDENT

QUESTIONNAIRE

MICROCOMPUTER PROJECT

STUDENT INTERVIEW QUESTIONS

NAME _____ SCHOOL _____

GRADE _____ GROUP _____

1. During the past two years you have been involved in studying and learning how to use computers:

   a. What activities did you complete in this program?

   b. What did you especially enjoy about the materials?

   c. Is there anything you disliked? (Describe)

d. The favorite thing you did in the computer program was:

e. How has the use of the computer software helped you in your school subjects?

f. Have you developed any projects as a result of this program? (Describe)

g. During the project have you or your parents purchased a computer for use at home?

YES _____ NO _____

If YES, was the purchase a result of your participation in the project?

YES _____ NO _____

APPENDIX G

LISTING OF IN-SERVICE ACTIVITIES

I N - S E R V I C E P R O G R A M M E

A. Dr. H. Hallworth and Professor A. Brebner, University of Calgary, were contracted and provided the initial in-service programme for teachers and administrators as follows:

1. April 22, 1982 - Explanation of the Parts of the Computer, Computer Terminology, A History of the Computer.

2. April 29, 1982 - Basic Explanation of the Operation of the Bell and Howell Microcomputer.

3. May 06, 1982 - Elements of Basic Programming: Instructions, Commands, Functions.

4. May 13, 1982 - Continuation of Basic Programming Skills.

5. May 20, 1982 - Basic Programming Topics, including Copying a Diskette, Initializing and Looping.

Several topics of computer literacy such as the following were discussed in the in-service programme: computer awareness, computer-assisted instruction, computer-managed instruction, and programming skills.

The in-service programme was evaluated by the staff participating in the sessions.

B. August 26, 1982 - Ms. Donna Iverson of JEM Research of Victoria conducted a session on the evaluation of courseware.

C. September 16, 1982 - Mr. Rob Cowie was assisted by Mr. Neil Hall (both are teachers in the Willow Creek School Division) in completing a well-received review of in-service topics completed to that time.

D. October 22, 1982 - Mr. Bob Martin, Electrical and Electronics Supervisor in the Willow Creek School Division, completed a full-day in-service on the topics: "The Line Printer and Its Utilization" and "An Introduction to Graphics."

E. It was necessary to cancel two planned in-service sessions by Dr. H. Hallworth for January and March, 1983.

F. May 19, 1983 - Mr. John Gray, University of Lethbridge, presented a workshop session on the topic of "Text Files." Mr. Gray completed a follow-up session on the same topic on June 27, 1983.

G. As a follow-up to the in-service activities, teaching resource materials were distributed to each of the teachers. The books Computer Tutor and Computers Don't Byte were distributed as teaching resources for developing computer awareness and literacy skills. In addition, a course developed for teaching computer literacy was circulated - Computer Literacy: Introductory Course of the Griffin Park School.

APPENDIX H

LISTING OF COURSEWARE USED IN THE STUDY

LISTING OF COURSEWARE USED IN THE STUDY

1. Algebra Drill and Practice 1 (Harper and Row)
2. Algebraic Expressions (Follett)
3. Basic Writing Competency Program (Follett)
4. English Achievement I - IV (Follett)
5. Graphics Processor Programs
6. Math Solving Equations - Levels 1-4 (Follett)
7. M.E.C.C. Math, Volunes I, II and III
8. M.E.C.C. Spelling, Volumes I and II
9. Milliken Math
10. Polynominal Practice (Sunburst)
11. Solving Quadratic Equations (Follett)
12. Spread Sheets
13. Survival Math (Sunburst)
14. Tobbs Learns Algebra (Sunburst)
15. Word Processing Programs

APPENDIX I

SAMPLE

OF

MICROCOMPUTER

BULLETIN

B U L L E T I N

OF THE

MICROCOMPUTER LEARNING PROJECT

Vol. I No. 1 Editors: Dr. G. Millar
Dr. A. MacLeod

It is the intention of this bulletin to highlight short articles (or excerpts) and to provide information and ideas for teachers involved in the Willow Creek Microcomputer Project.

I. UPCOMING EVENTS

1. Bob Martin will continue basic and more advanced instruction on October 22 at F. P. Walshe School.

2. Dr. Hallworth will give a presentation on "Problem Solving using Microcomputers" on January 28 (tentatively).

II. ARTICLES OF INTEREST TO TEACHERS AND STUDENTS

An excellent article on computer literacy is attached, entitled "Computer Literacy". As one primary focus of our project is computer literacy, it is suggested that we consider seriously adopting the criteria of this definition in determining direction for our students.

ACCESS has begun production of a periodical entitled Bandwidth which is a special projects newsletter. In Volume 1, p. 13, there is an interesting article entitled "The Electronic Briefcase". In Volume 2, p. 35, note the discussion of the Laser Disc, and on p. 47, "On the Importance of Taking Computers Seriously".

ACCESS has recently added three computer literacy videotapes of potential interest to us.

1. Parts of the Computer--Input/Output (12-15 min.)
2. Computers, Calculators and Electronic Video Games (10 min.)
3. How Computers are Used (15 min.)

Alberta Education has recently released a listing of Supplementary Resources (print materials), including suggested grade levels for readability. This material is available from the Superintendent's Office.

III. PROJECT IDEAS

It is recommended that students be expected to complete projects that demonstrate understanding of the concepts involved in computer awareness and literacy. Some suggested ideas for projects include "The Use of Computers in Everyday Life". Students could collect articles and write precis of them noting similarities, differences, and trends in the use and applications of computers in society. Teachers are encouraged to collect articles with a view to developing a bank of resource materials apropos to computers. It is suggested that a field trip within your local town be considered to examine types of computers and to interact with users of the computers to enhance student understanding.

Your ideas regarding projects are solicited so that we can share them with other project personnel. It is planned that examples of exemplary projects could be included in the research monograph to be published by the Department of Education.

A P P E N D I X J

DESCRIPTIVE STATISTICS

FOR ALL STUDENTS IN PROJECT

FOR

S. O. S.,

TEST OF DIVERGENT THINKING,

AND

C. T. B. S.

BY GROUPS, STATUS AND GRADE LEVELS

TABLE A

RESULTS OF SELF OBSERVATION SCALE BY TREATMENT/COMPARISON GROUPS FOR TOTAL PROJECT GROUP

TREATMENT GROUP SCALE	PRE (N=78)		POST (N=77)		GAIN (N=75)	
	X	SD	X	SD	X	SD
Self-acceptance	61.70	22.51	61.69	20.84	.45	24.40
Self-security	60.22	31.46	56.71	34.31	-3.64	36.56
Self-confidence	72.15	18.90	74.90	16.58	2.85	21.96
Self-assurance	45.60	27.79	51.52	31.05	5.97	32.27
Peer affiliation	56.58	28.01	52.54	29.04	-4.23	31.91
Teacher affiliation	71.31	18.11	63.62	22.64	-7.65	23.80
School affiliation	66.32	27.38	59.52	29.19	-7.25	27.65

COMPARISON GROUP SCALE	PRE (N=40)		POST (N=38)		GAIN (N=37)	
	X	SD	X	SD	X	SD
Self-acceptance	65.75	20.46	64.40	22.50	-2.43	21.50
Self-security	47.35	30.49	50.97	29.54	5.78	27.58
Self-confidence	66.68	24.58	76.32	19.67	8.19	19.34
Self-assurance	55.58	33.60	63.55	33.70	7.46	25.57
Peer affiliation	58.25	27.28	58.40	27.74	-1.11	22.29
Teacher affiliation	74.35	17.68	70.45	21.05	-3.76	22.77
School affiliation	72.62	22.45	73.74	24.72	1.86	24.76

TABLE B

RESULTS OF TEST OF DIVERGENT THINKING BY TREATMENT/COMPARISON GROUPS FOR TOTAL PROJECT GROUP

TREATMENT GROUP

SCALE	PRE (N=77)		POST (N=76)		GAIN (N=73)	
	X	SD	X	SD	X	SD
Fluency	8.31	3.02	10.60	2.15	2.25	3.56
Flexibility	5.24	2.45	7.28	2.17	1.94	3.01
Originality	21.96	7.90	27.57	6.20	5.26	9.33
Elaboration	8.99	4.70	11.54	3.75	2.49	5.35
Title	17.22	8.29	21.74	6.64	4.32	7.85

COMPARISON GROUP

SCALE	PRE (N=40)		POST (N=38)		GAIN (N=37)	
	X	SD	X	SD	X	SD
Fluency	9.28	2.51	9.10	2.53	-0.22	2.77
Flexibility	5.41	2.12	6.58	2.31	1.31	2.74
Originality	20.68	6.53	22.34	6.64	1.65	6.89
Elaboration	9.22	3.35	9.32	4.11	0.22	4.86
Title	19.25	6.81	18.82	5.78	-0.78	6.94

TABLE C

RESULTS OF CANADIAN TEST OF BASIC SKILLS BY TREATMENT/COMPARISON GROUPS FOR TOTAL PROJECT GROUP

TREATMENT GROUP	PRE	(N=65)	POST	(N=64)	GAIN	(N=64)
SCALE	X	SD	X	SD	X	SD
Vocabulary	8.28	1.42	9.64	1.32	1.32	.58
Reading	8.40	1.22	9.81	1.18	1.38	.73
Math - Concepts	8.39	1.48	10.27	1.46	1.84	.79
Math - Problems	8.10	1.52	9.71	1.65	1.57	1.13

COMPARISON GROUP	PRE	(N=34)	POST	(N=32)	GAIN	(N=32)
SCALE	X	SD	X	SD	X	SD
Vocabulary	8.74	1.39	9.89	1.17	1.01	.76
Reading	8.62	1.44	9.62	1.91	.90	1.03
Math - Concepts	8.71	1.90	10.52	1.64	1.71	.82
Math - Problems	8.04	1.64	9.55	1.65	1.42	1.13

TABLE D

RESULTS OF SELF OBSERVATION SCALE BY GIFTED/REGULAR STATUS

FOR TOTAL PROJECT GROUP

GIFTED SCALE	PRE (N=57)		POST (N=58)		GAIN (N=56)	
	X	SD	X	SD	X	SD
Self-acceptance	68.46	18.80	69.50	18.59	.89	19.50
Self-security	60.00	30.71	60.31	31.50	1.27	29.12
Self-confidence	71.02	22.78	80.14	13.82	9.21	19.98
Self-assurance	54.54	29.01	62.09	31.16	7.89	29.19
Peer affiliation	54.25	29.30	57.26	28.03	3.14	28.57
Teacher affiliation	74.72	17.01	71.88	16.30	-2.68	20.44
School affiliation	73.49	23.56	66.67	27.60	-6.20	22.45

REGULAR SCALE	PRE (N=61)		POST (N=57)		GAIN (N=56)	
	X	SD	X	SD	X	SD
Self-acceptance	58.05	23.38	55.54	21.81	-1.89	26.89
Self-security	51.98	32.18	49.23	33.41	-2.32	38.50
Self-confidence	69.62	19.48	70.51	19.68	0.02	21.55
Self-assurance	43.79	30.44	48.79	32.34	5.04	31.21
Peer affiliation	59.85	25.98	51.65	29.21	-9.54	28.31
Teacher affiliation	70.12	18.64	59.77	25.77	-10.05	25.74
School affiliation	63.75	27.25	61.72	29.41	-2.29	30.92

TABLE E

RESULTS OF TEST OF DIVERGENT THINKING BY GIFTED/REGULAR STATUS

FOR TOTAL PROJECT GROUP

GIFTED	PRE (N=57)		POST (N=57)		GAIN (N=55)	
SCALE	X	SD	X	SD	X	SD
Fluency	8.67	2.72	10.47	2.02	1.74	3.28
Flexibility	5.24	2.34	7.44	2.16	2.17	2.62
Originality	21.95	6.62	27.10	6.11	4.93	8.10
Elaboration	9.47	3.79	11.51	4.01	2.18	5.56
Title	19.07	7.76	22.40	5.94	3.02	7.08

REGULAR	PRE (N=60)		POST (N=57)		GAIN (N=55)	
SCALE	X	SD	X	SD	X	SD
Fluency	8.62	3.05	9.74	2.66	1.09	3.72
Flexibility	5.36	2.34	6.65	2.26	1.30	3.17
Originality	21.10	8.21	24.54	7.23	3.16	9.29
Elaboration	8.68	4.68	10.09	3.88	1.27	4.99
Title	16.81	7.82	19.12	6.65	2.18	8.70

TABLE F

RESULTS OF CANADIAN TEST OF BASIC SKILLS BY GIFTED/REGULAR STATUS

FOR TOTAL PROJECT GROUP

GRADES 7 - 9

GIFTED	PRE	(N=49)	POST	(N=49)	GAIN	(N=49)
SCALE	X	SD	X	SD	X	SD
Vocabulary	9.21	1.12	10.36	.99	1.14	.73
Reading	9.16	.92	10.42	.95	1.26	.76
Math - Concepts	9.32	1.30	11.14	1.10	1.82	.84
Math - Problems	8.84	1.34	10.42	1.41	1.58	1.06

REGULAR	PRE	(N=50)	POST	(N=47)	GAIN	(N=47)
SCALE	X	SD	X	SD	X	SD
Vocabulary	7.67	1.27	9.06	1.20	1.29	.58
Reading	7.81	1.28	9.05	1.56	1.17	.97
Math - Concepts	7.70	1.53	9.53	1.47	1.76	.77
Math - Problems	7.32	1.38	8.86	1.50	1.45	1.20

TABLE G

RESULTS OF SELF OBSERVATION SCALE BY GRADE LEVEL

FOR TOTAL PROJECT GROUP

GRADE 7 - MEAN SCORES

SCALE	PRE (N=31)		POST (N=29)		GAIN (N=29)	
	X	SD	X	SD	X	SD
Self-acceptance	63.13	23.80	56.41	24.68	- 5.38	30.69
Self-security	61.32	30.37	44.13	30.80	-15.17	33.88
Self-confidence	66.29	21.72	72.72	20.20	7.14	30.50
Self-assurance	52.16	35.09	55.00	31.78	4.97	31.95
Peer affiliation	56.16	27.84	47.72	32.49	- 7.41	38.91
Teacher affiliation	79.19	10.58	65.48	20.35	-13.48	22.26
School affiliation	69.81	24.34	57.48	33.48	-11.79	27.40

GRADE 8 - MEAN SCORES

SCALE	PRE (N=38)		POST (N=39)		GAIN (N=37)	
	X	SD	X	SD	X	SD
Self-acceptance	64.71	20.40	65.28	19.07	0.78	19.35
Self-security	57.50	31.42	59.08	32.64	2.46	36.49
Self-confidence	75.76	14.84	76.77	13.72	1.00	16.71
Self-assurance	43.13	23.28	53.82	30.42	9.40	32.00
Peer affiliation	62.10	23.88	60.69	25.65	- 1.40	21.37
Teacher affiliation	72.97	17.21	63.15	25.47	- 9.97	22.01
School affiliation	71.40	23.76	64.41	27.28	- 7.81	30.01

Continued on next page

TABLE G

(Continued)

GRADE 9 - MEAN SCORES

SCALE	PRE (N=28)		POST (N=29)		GAIN (N=28)	
	X	SD	X	SD	X	SD
Self-acceptance	64.11	20.08	67.48	18.89	3.18	22.03
Self-security	54.18	34.42	63.38	34.28	10.96	28.40
Self-confidence	68.25	22.26	73.76	19.79	5.14	16.66
Self-assurance	53.25	33.75	61.72	35.98	7.25	28.76
Peer affiliation	50.57	30.87	53.00	27.90	1.71	23.16
Teacher affiliation	65.39	20.93	65.38	20.01	- 0.29	24.28
School affiliation	62.96	28.29	62.69	26.88	1.21	24.56

GRADE 10 - MEAN SCORES

SCALE	PRE (N=21)		POST (N=18)		GAIN (N=18)	
	X	SD	X	SD	X	SD
Self-acceptance	58.67	24.46	58.78	22.66	- 1.00	20.00
Self-security	47.05	29.91	49.06	30.55	- 0.94	31.06
Self-confidence	69.05	26.84	79.17	17.31	7.12	17.97
Self-assurance	49.19	28.53	49.89	32.05	1.61	26.64
Peer affiliation	58.38	29.32	54.28	28.90	- 7.72	32.97
Teacher affiliation	70.33	20.78	73.22	21.44	3.06	23.20
School affiliation	68.48	29.10	77.11	22.03	6.78	18.53

NOTE: Values have been rounded to two decimal places.
"N" stands for the number of valid responses per variable.

TABLE H

RESULTS OF TEST OF DIVERGENT THINKING BY GRADE LEVEL

FOR TOTAL PROJECT GROUP

GRADE 7	PRE	(N=31)	POST	(N=29)	GAIN	(N=29)
SCALE	X	SD	X	SD	X	SD
Fluency	7.84	2.88	10.52	1.92	2.79	3.33
Flexibility	4.87	2.39	7.10	1.88	2.36	2.41
Originality	19.48	7.14	25.76	6.54	6.69	9.02
Elaboration	7.81	3.82	10.38	3.34	2.79	4.55
Title	16.26	7.44	19.93	5.22	3.79	7.71

GRADE 8	PRE	(N=39)	POST	(N=38)	GAIN	(N=37)
SCALE	X	SD	X	SD	X	SD
Fluency	7.54	2.66	10.45	2.40	2.73	3.51
Flexibility	4.71	2.45	7.10	2.28	2.19	3.51
Originality	19.13	7.02	26.26	6.63	6.60	8.77
Elaboration	8.00	3.63	10.47	3.80	2.30	5.04
Title	14.69	6.59	21.26	6.14	6.05	8.09

GRADE 9	PRE	(N=28)	POST	(N=29)	GAIN	(N=28)
SCALE	X	SD	X	SD	X	SD
Fluency	10.32	2.28	9.45	2.41	-0.82	2.71
Flexibility	6.00	1.98	6.93	2.27	1.04	2.38
Originality	26.00	6.54	24.97	6.70	-1.00	7.03
Elaboration	10.36	3.92	11.24	4.95	1.14	5.96
Title	21.89	7.95	20.69	6.71	-1.32	7.20

Continued on next page

TABLE H

(Continued)

GRADE 10

SCALE	PRE	(N=18)	POST	(N=18)	GAIN	(N=16)
	X	SD	X	SD	X	SD
Fluency	9.74	2.75	9.78	2.84	-0.19	2.40
Flexibility	6.22	2.07	7.00	2.74	0.75	2.89
Originality	23.22	7.12	26.39	7.99	2.19	6.83
Elaboration	11.56	5.35	11.44	3.82	-0.50	5.46
Title	21.61	7.17	21.17	8.75	-0.69	4.50

NOTE: Values have been rounded to two decimal places.
N refers to the number of valid responses.

TABLE I

RESULTS OF CANADIAN TEST OF BASIC SKILLS BY GRADE LEVEL

FOR TOTAL TREATMENT GROUP

GRADE 7 - GRADE EQUIVALENTS

SCALE	PRE (N=31)		POST (N=31)		GAINS (N=31) (Gr. Equiv.)	
	X	SD	X	SD	X	SD
Vocabulary	7.58	1.21	8.74	1.00	1.08	0.39
Reading	7.39	1.18	8.82	1.80	1.40	1.16
Math - Concepts	7.26	1.42	9.09	1.22	1.81	0.88
Math - Problems	7.11	1.07	8.58	1.37	1.43	0.87

GRADE 8 - GRADE EQUIVALENTS

SCALE	PRE (N=40)		POST (N=40)		GAINS (N=40) (Gr. Equiv.)	
	X	SD	X	SD	X	SD
Vocabulary	8.34	1.27	10.01	1.28	1.61	0.59
Reading	8.68	1.05	10.07	1.11	1.34	0.68
Math - Concepts	8.57	1.05	10.63	1.34	2.00	0.75
Math - Problems	8.09	1.35	9.93	1.47	1.79	1.02

GRADE 9 - GRADE EQUIVALENTS

SCALE	PRE (N=29)		POST (N=29)		GAINS (N=29) (Gr. Equiv.)	
	X	SD	X	SD	X	SD
Vocabulary	9.52	1.14	10.33	0.89	0.81	0.68
Reading	9.40	0.85	10.25	0.98	0.85	0.63
Math - Concepts	9.79	1.53	11.28	1.15	1.50	0.71
Math - Problems	9.18	1.60	10.39	1.62	1.22	1.43

Continued on next page

TABLE I
(Continued)

GRADE 10 - CONVERTED STANDARD SCORES (N = 21)

SCALES	PRE		POST		GAINS	
	X	SD	X	SD	X	SD
Reading	145.19	16.14	187.00	30.66	42.94	19.84
Math	150.47	18.18	184.50	29.91	34.29	22.00

NOTE: Values have been rounded to two decimal places.
"N" stands for the number of valid responses.

A P P E N D I X K

MEANS AND STANDARD DEVIATIONS

OF

TREATMENT AND COMPARISON STUDENTS' RESPONSES

ON THE

COMPUTER LITERACY QUESTIONNAIRE

TABLE J

ANALYSIS OF STUDENTS' PRE- AND POST-TEST RESPONSES TO QUESTIONS ON COMPUTER LITERACY QUESTIONNAIRE BY TREATMENT AND COMPARISON GROUPS

	TREATMENT				COMPARISON			
	PRE	(N=78)	POST	(N=77)	PRE	(N=40)	POST	(N=38)
QUESTION	X	SD	X	SD	X	SD	X	SD
*ATTITUDES TOWARD COMPUTERS**								
1	4.78	0.53	4.47	0.68	4.70	0.72	4.76	0.49
2	1.82	0.80	1.62	0.74	1.88	0.76	1.63	0.85
3	2.04	0.96	1.78	0.90	2.36	1.06	2.34	1.07
4	1.88	1.02	1.77	1.02	1.75	1.08	1.76	1.00
5	4.69	0.73	4.56	0.88	4.75	0.63	4.82	0.46
6	4.67	0.68	4.29	0.93	4.50	0.96	4.47	0.80
7	4.46	0.77	4.42	0.73	4.10	0.90	4.24	0.88
8	1.76	0.88	1.56	0.70	1.85	0.86	1.60	0.82
9	1.91	0.88	1.88	0.76	2.10	0.96	2.13	0.88
10	4.56	0.80	4.44	0.70	4.40	0.74	4.50	0.69
11	4.08	0.78	3.95	0.83	3.72	1.09	3.47	1.06
12	1.96	0.85	2.17	1.03	1.92	0.83	1.84	0.79
13	3.92	0.79	4.12	0.76	3.98	0.80	4.14	0.75
14	3.91	0.99	4.03	0.96	3.52	1.06	3.50	1.13
15	2.34	1.11	2.73	1.15	2.15	1.00	2.21	0.99
16	4.38	0.92	4.49	0.81	4.60	0.87	4.63	0.63
17	2.31	1.08	2.33	1.05	2.64	1.06	2.13	0.88
18	1.87	1.00	1.77	0.93	1.85	0.86	1.76	0.91
19	4.61	0.63	4.51	0.66	4.55	0.71	4.60	0.76
20	1.94	1.05	1.97	1.19	1.98	1.07	1.86	1.00
21	3.70	1.23	3.65	0.98	3.58	1.17	4.14	0.89
22	3.37	1.08	3.78	1.07	3.65	1.17	4.05	0.98
23	3.89	1.12	3.63	1.13	3.85	1.41	3.26	1.29

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TABLE J
(Continued)

	TREATMENT				COMPARISON			
	PRE	(N=78)	POST	(N=77)	PRE	(N=40)	POST	(N=38)
QUESTION	X	SD	X	SD	X	SD	X	SD
*ATTITUDES TOWARD COMPUTERS** (continued)								
24.	3.49	0.89	3.58	1.09	3.42	1.01	3.50	0.95
25.	3.73	0.90	3.84	0.97	4.00	0.93	4.09	1.07
26.	4.13	0.66	4.20	0.63	4.28	0.60	4.54	0.62
27.	3.67	0.91	3.95	0.79	4.05	0.82	4.06	1.09
28.	4.15	0.77	4.16	0.63	4.31	0.52	4.33	0.74
29.	4.45	0.68	4.43	0.55	4.52	0.75	4.39	0.79
30.	1.73	0.83	1.74	0.73	2.02	1.10	1.76	0.97
*IMPORTANCE OF VALUES***								
31.	2.84	0.37	2.88	0.32	2.75	0.44	2.82	0.39
32.	2.92	0.27	2.91	0.29	2.92	0.27	3.00	0.00
33.	2.37	0.56	2.40	0.52	2.28	0.60	2.54	0.51
34.	2.35	0.51	2.22	0.53	2.42	0.59	2.27	0.63
35.	2.52	0.57	2.75	0.44	2.50	0.64	2.52	0.62
36.	2.39	0.59	2.30	0.54	2.38	0.63	2.46	0.56
37.	2.25	0.56	2.14	0.53	2.32	0.53	2.33	0.54
38.	2.22	0.57	2.31	0.52	2.40	0.54	2.48	0.51
39.	2.76	0.43	2.95	0.22	2.82	0.50	2.94	0.35
40.	2.67	0.53	2.83	0.38	2.72	0.55	2.88	0.42
*DESCRIBING COMPUTERS****								
41.	1.65	0.80	1.80	0.93	1.85	0.86	1.91	0.96
42.	3.30	0.88	3.09	1.00	3.65	0.62	3.25	0.95
43.	3.60	0.59	3.53	0.62	3.62	0.54	3.59	0.56
44.	2.06	0.90	1.87	0.90	2.20	0.79	2.03	0.93

Continued on next page

TABLE J

(Continued)

	TREATMENT				COMPARISON			
	PRE	(N=78)	POST	(N=77)	PRE	(N=40)	POST	(N=38)
QUESTION	X	SD	X	SD	X	SD	X	SD
*DESCRIBING COMPUTERS*** (continued)								
45.	3.32	0.61	3.40	0.52	3.50	0.56	3.53	0.57
46.	3.91	0.40	3.88	0.43	3.88	0.40	3.94	0.35
47.	2.78	0.98	2.83	0.89	2.80	1.02	2.69	1.00
48.	3.08	0.86	2.96	0.95	3.08	0.92	3.09	1.06

* Based on a 1 to 5 scale, where 1 = strongly agree
5 = strongly disagree

** Based on a 1 to 3 scale, where 1 = unimportant
2 = important
3 = extremely important

*** Based on a 1 to 4 choice, where 1 indicated a response expressing a most negative feeling about computers and 4 indicated a most positive feeling.

TABLE K

ANALYSIS OF STUDENTS' PRE- AND POST-TEST RESPONSES TO QUESTIONS ON COMPUTER LITERACY QUESTIONNAIRE FOR THE TREATMENT GROUP, BY SEX

	MALES				FEMALES			
	PRE	(N=47)	POST	(N=45)	PRE	(N=31)	POST	(N=32)
QUESTION	X	SD	X	SD	X	SD	X	SD
*ATTITUDES TOWARD COMPUTERS**								
1.	4.83	0.43	4.58	0.75	4.71	0.64	4.31	0.54
2.	1.77	0.81	1.47	0.66	1.90	0.79	1.84	0.81
3.	1.98	0.90	1.67	0.74	2.13	1.06	1.94	1.08
4.	1.74	0.87	1.62	0.94	2.10	1.19	1.97	1.12
5.	4.85	0.62	4.60	0.99	4.45	0.81	4.50	0.72
6.	4.74	0.57	4.42	0.92	4.55	0.81	4.09	0.93
7.	4.56	0.75	4.58	0.72	4.29	0.78	4.19	0.69
8.	1.57	0.68	1.47	0.62	2.03	1.08	1.69	0.78
9.	1.89	0.91	1.76	0.74	1.94	0.84	2.06	0.76
10.	4.66	0.79	4.56	0.72	4.41	0.80	4.28	0.63
11.	4.19	0.68	4.11	0.71	3.91	0.89	3.72	0.92
12.	1.83	0.84	2.00	1.02	2.16	0.85	2.41	1.01
13.	4.00	0.83	4.20	0.87	3.81	0.70	4.00	0.57
14.	3.92	1.04	4.11	0.94	3.91	0.93	3.91	1.00
15.	2.36	1.07	2.51	1.12	2.31	1.18	3.03	1.15
16.	4.30	0.83	4.31	0.79	4.50	1.05	4.75	0.76
17.	1.98	0.94	2.00	0.77	2.81	1.11	2.81	1.22
18.	1.96	0.93	2.00	1.02	1.75	1.11	1.44	0.67
19.	4.55	0.62	4.33	0.74	4.69	0.64	4.75	0.44
20.	2.26	1.11	2.29	1.24	1.47	0.76	1.52	0.96
21.	3.66	1.37	3.62	0.94	3.75	1.02	3.69	1.06
22.	3.38	1.17	3.71	1.10	3.34	0.94	3.87	1.02
23.	3.89	1.18	3.52	1.09	3.88	1.04	3.78	1.18

Continued on next page

TABLE K
(Continued)

	MALES				FEMALES			
	PRE	(N=47)	POST	(N=45)	PRE	(N=31)	POST	(N=32)
QUESTION	X	SD	X	SD	X	SD	X	SD
*ATTITUDES TOWARD COMPUTERS** (continued)								
24.	3.62	0.87	3.47	1.12	3.31	0.90	3.75	1.05
25.	3.70	0.88	3.78	1.00	3.78	0.94	3.94	0.95
26.	4.18	0.65	4.22	0.64	4.06	0.67	4.16	0.63
27.	3.77	0.79	4.00	0.77	3.52	1.06	3.88	0.83
28.	4.23	0.60	4.24	0.61	4.03	0.98	4.03	0.65
29.	4.43	0.68	4.47	0.55	4.48	0.68	4.38	0.55
30.	1.70	0.86	1.69	0.76	1.78	0.79	1.18	0.69
*IMPORTANCE OF VALUES***								
31.	2.89	0.31	2.91	0.29	2.75	0.44	2.84	0.37
32.	2.94	0.25	2.91	0.29	2.91	0.30	2.91	0.30
33.	2.34	0.56	3.38	0.49	2.41	0.56	2.44	0.56
34.	2.40	0.50	2.25	0.49	2.28	0.52	2.19	0.59
35.	2.62	0.49	2.80	0.41	2.38	0.66	2.69	0.47
36.	2.47	0.55	2.31	0.51	2.28	0.63	2.28	0.58
37.	2.40	0.50	2.20	0.59	2.03	0.60	2.06	0.44
38.	2.32	0.59	2.38	0.54	2.06	0.51	2.22	0.49
39.	2.74	0.44	2.91	0.29	2.78	0.42	3.00	0.00
40.	2.64	0.53	2.80	0.40	2.71	0.53	2.88	0.34
*DESCRIBING COMPUTERS****								
41.	1.83	0.82	1.93	1.01	1.38	0.71	1.62	0.79
42.	3.44	0.89	3.31	0.95	3.09	0.86	2.78	1.01
43.	3.67	0.47	3.60	0.65	3.50	0.72	3.44	0.56
44.	2.20	0.98	2.00	0.90	1.88	0.75	1.68	0.87

Continued on next page

TABLE K
(Continued)

	MALES				FEMALES			
	PRE	(N=47)	POST	(N=45)	PRE	(N=31)	POST	(N=32)
QUESTION	X	SD	X	SD	X	SD	X	SD
*DESCRIBING COMPUTERS**** *(continued)*								
45.	3.24	0.56	3.47	0.55	3.44	0.67	3.31	0.47
46.	3.94	0.25	3.89	0.38	3.87	0.56	3.88	0.49
47.	2.89	1.04	2.91	0.87	2.61	0.88	2.72	0.92
48.	3.24	0.70	3.04	1.06	2.84	1.02	2.84	0.77

* Based on a 1 to 5 scale, where 1 = strongly agree
5 = strongly disagree

** Based on a 1 to 3 scale, where 1 = unimportant
2 = important
3 = extremely important

*** Based on a 1 to 4 choice, where 1 indicated a response expressing a most negative feeling about computers and 4 indicated a most positive feeling.

TABLE L

ANALYSIS OF STUDENTS' PRE- AND POST-TEST RESPONSES TO QUESTIONS ON COMPUTER LITERACY QUESTIONNAIRE FOR THE TREATMENT GROUP, BY STATUS

	GIFTED				REGULAR			
	PRE	(N=38)	POST	(N=38)	PRE	(N=40)	POST	(N=39)
QUESTION	X	SD	X	SD	X	SD	X	SD
*ATTITUDES TOWARD COMPUTERS**								
1.	4.76	0.63	4.45	0.76	4.80	0.40	4.49	0.60
2.	1.79	0.74	1.55	0.60	1.85	0.86	1.69	0.86
3.	2.05	0.87	1.53	0.56	2.02	1.05	2.03	1.09
4.	1.97	0.92	1.66	0.91	1.80	1.11	1.87	1.13
5.	4.63	0.85	4.47	0.98	4.75	0.59	4.64	0.78
6.	4.58	0.76	4.37	0.85	4.75	0.59	4.20	1.00
7.	4.35	0.89	4.40	0.76	4.55	0.64	4.44	0.72
8.	1.79	0.94	1.53	0.51	1.72	0.85	1.59	0.85
9.	1.82	0.73	1.90	0.80	2.00	1.00	1.87	0.73
10.	4.53	0.92	4.45	0.76	4.58	0.67	4.44	0.64
11.	4.03	0.85	4.10	0.65	4.12	0.71	3.80	0.95
12.	1.82	0.83	1.82	0.83	2.10	0.86	2.51	1.10
13.	4.00	0.77	4.21	0.70	3.85	0.80	4.03	0.81
14.	4.03	0.97	4.05	0.96	3.80	1.00	4.00	0.97
15.	2.18	1.01	2.40	1.03	2.49	1.19	3.05	1.19
16.	4.50	0.83	4.50	0.69	4.27	1.00	4.49	0.91
17.	2.24	1.10	2.18	0.96	2.38	1.08	2.47	1.13
18.	1.84	0.97	1.87	1.02	1.90	1.04	1.67	0.84
19.	4.66	0.48	4.42	0.68	4.56	0.74	4.59	0.64
20.	1.76	1.00	2.08	1.28	2.10	1.09	1.87	1.10
21.	4.03	1.08	3.90	1.01	3.39	1.30	3.41	0.91
22.	3.60	1.10	3.84	1.04	3.15	1.01	3.72	1.10
23.	4.03	0.85	3.53	1.06	3.76	1.32	3.74	1.20

Continued on next page

TABLE L
(Continued)

	GIFTED				REGULAR			
	PRE	(N=38)	POST	(N=38)	PRE	(N=40)	POST	(N=39)
QUESTION	X	SD	X	SD	X	SD	X	SD
*ATTITUDES TOWARD COMPUTERS** (continued)								
24.	3.37	0.85	3.55	1.00	3.61	0.92	3.62	1.18
25.	3.87	0.81	3.95	0.84	3.61	0.97	3.74	1.09
26.	4.18	0.69	4.05	0.57	4.08	0.62	4.33	0.66
27.	3.68	0.81	3.84	0.72	3.65	1.00	4.05	0.86
28.	4.26	0.64	3.97	0.59	4.05	0.88	4.33	0.62
29.	4.58	0.55	4.42	0.55	4.32	0.76	4.44	0.55
30.	1.68	0.74	1.66	0.71	1.78	0.91	1.82	0.76
*IMPORTANCE OF VALUES***								
31.	2.87	0.34	2.90	0.31	2.80	0.40	2.87	0.34
32.	2.97	0.16	2.92	0.27	2.88	0.33	2.90	0.31
33.	2.37	0.54	2.45	0.56	2.37	0.58	2.36	0.49
34.	2.24	0.43	2.27	0.56	2.46	0.55	2.18	0.51
35.	2.55	0.50	2.73	0.45	2.49	0.64	2.77	0.43
36.	2.42	0.55	2.24	0.54	2.37	0.62	2.36	0.54
37.	2.21	0.47	2.10	0.51	2.29	0.64	2.18	0.56
38.	2.34	0.48	2.32	0.52	2.10	0.63	2.31	0.52
39.	2.87	0.34	2.92	0.27	2.66	0.48	2.97	0.16
40.	2.66	0.53	2.74	0.45	2.68	0.53	2.92	0.27
*DESCRIBING COMPUTERS****								
41.	1.79	0.88	1.82	0.90	1.51	0.71	1.80	0.98
42.	3.50	0.76	3.32	0.90	3.10	0.96	2.87	1.06
43.	3.55	0.69	3.47	0.69	3.65	0.48	3.59	0.55
44.	2.10	0.89	1.79	0.88	2.02	0.92	1.95	0.93

Continued on next page

TABLE L
(Continued)

	GIFTED				REGULAR			
	PRE	(N=38)	POST	(N=38)	PRE	(N=40)	POST	(N=39)
QUESTION	X	SD	X	SD	X	SD	X	SD
*DESCRIBING COMPUTERS*** (continued)								
45.	3.26	0.60	3.32	0.52	3.38	0.63	3.49	0.51
46.	4.00	0.00	3.92	0.36	3.82	0.55	3.85	0.49
47.	2.71	1.04	2.90	0.92	2.85	0.93	2.77	0.87
48.	3.32	0.74	3.10	1.01	2.85	0.92	2.82	0.88

* Based on a 1 to 5 scale, where 1 = strongly agree
5 = strongly disagree

** Based on a 1 to 3 scale, where 1 = unimportant
2 = important
3 = extremely important

*** Based on a 1 to 4 choice, where 1 indicated a response expressing a most negative feeling about computers and 4 indicated a most positive feeling.

TABLE M

ANALYSIS OF STUDENTS' PRE- AND POST-TEST RESPONSES TO QUESTIONS ON THE COMPUTER LITERACY QUESTIONNAIRE - PART II FOR THE TREATMENT AND COMPARISON GROUPS

QUESTION		TREATMENT GROUP N = 80 PRE-TEST Adjusted Frequency (%)	TREATMENT GROUP N = 80 POST-TEST Adjusted Frequency (%)	COMPARISON GROUP N = 39 PRE-TEST Adjusted Frequency (%)	COMPARISON GROUP N = 39 POST-TEST Adjusted Frequency (%)
1.	a.	96.2	96.1	95.0	97.4
	b.	1.3	0.0	0.0	0.0
	c.	2.5	3.9	5.0	2.6
2.	a.	12.7	7.8	25.0	13.2
	b.	73.4	71.4	50.0	68.4
	c.	13.9	20.8	25.0	18.4
3.	a.	6.3	1.3	5.0	0.0
	b.	89.9	97.4	85.0	100.0
	c.	3.8	1.3	10.0	0.0
4.	a.	5.1	0.0	5.0	5.3
	b.	91.1	96.1	9.5	94.7
	c.	3.8	3.9	0.0	0.0
5.	a.	79.7	87.0	87.5	86.8
	b.	7.6	1.3	7.5	5.3
	c.	12.7	11.7	5.0	7.9
6.	a.	97.5	98.7	97.4	97.4
	b.	0.0	1.3	2.6	0.0
	c.	2.5	0.0	0.0	2.6
7.	a.	43.0	27.3	5.5	28.9
	b.	46.8	61.0	4.0	60.5
	c.	10.1	11.7	5.0	10.5
8.	a.	24.1	3.9	20.0	7.9
	b.	54.4	74.0	47.5	73.7
	c.	21.5	22.1	32.5	18.4
9.	a.	75.9	75.3	65.0	81.6
	b.	10.1	3.9	17.5	2.6
	c.	13.9	20.8	17.5	15.8
10.	a.	31.6	57.1	37.5	71.1
	b.	51.9	19.5	55.0	15.8
	c.	16.5	23.4	7.5	13.2

Continued on next page

TABLE M

(Continued)

QUESTION		TREATMENT GROUP N = 80 PRE-TEST Adjusted Frequency (%)	TREATMENT GROUP N = 80 POST-TEST Adjusted Frequency (%)	COMPARISON GROUP N = 39 PRE-TEST Adjusted Frequency (%)	COMPARISON GROUP N = 39 POST-TEST Adjusted Frequency (%)
11.	a.	65.8	93.5	7.0	100.0
	b.	12.7	1.3	10.0	0.0
	c.	21.5	5.2	20.0	0.0
12.	a.	31.6	20.8	32.5	44.7
	b.	49.4	63.6	50.0	39.5
	c.	19.0	15.6	17.5	15.8
13.	a.	59.5	59.7	65.0	81.6
	b.	24.1	18.2	25.0	2.6
	c.	16.5	22.1	10.0	15.8
14.	a.	92.4	97.4	87.5	97.4
	b.	2.5	2.6	0.0	2.6
	c.	5.1	0.0	12.5	0.0
15.	a.	84.8	96.1	82.5	100.0
	b.	12.7	2.6	10.0	0.0
	c.	2.5	1.3	7.5	0.0
16.	a.	36.4	19.5	30.8	7.9
	b.	55.8	70.1	53.8	81.6
	c.	7.8	10.4	15.4	10.5
17.	a.	24.4	7.8	28.2	10.5
	b.	71.8	92.2	66.7	81.6
	c.	3.8	0.0	5.1	7.9
18.	a.	79.5	83.1	86.8	89.5
	b.	11.5	5.2	7.9	2.6
	c.	9.0	11.7	5.3	7.9
19.	a.	0.0	0.0	0.0	0.0
	b.	94.8	94.8	100.0	100.0
	c.	5.2	5.2	0.0	0.0
20.	a.	57.7	35.1	66.7	50.0
	b.	34.6	63.6	28.2	44.7
	c.	7.7	1.3	5.1	5.3
21.	a.	3.8	2.6	5.1	2.6
	b.	6.4	0.0	5.1	2.6
	c.	59.0	83.1	71.8	76.3
	d.	2.6	1.3	7.7	18.4
	e.	28.2	13.0	10.3	0.0

Continued on next page

TABLE M

(Continued)

		TREATMENT GROUP N = 80		COMPARISON GROUP N = 39	
		PRE-TEST Adjusted Frequency (%)	POST-TEST Adjusted Frequency (%)	PRE-TEST Adjusted Frequency (%)	POST-TEST Adjusted Frequency (%)
22.	a.	16.7	11.7	10.3	5.3
	b.	59.0	72.7	71.8	86.8
	c.	5.1	0.0	5.1	7.9
	d.	6.4	2.6	5.1	0.0
	e.	12.8	13.0	7.7	0.0
23.	a.	34.6	9.1	23.1	21.1
	b.	46.2	84.4	53.8	76.3
	c.	7.7	5.2	10.3	0.0
	d.	3.8	1.3	5.1	2.6
	e.	7.7	0.0	7.7	0.0
24.	a.	8.9	14.3	5.0	26.3
	b.	53.2	51.9	52.5	42.1
	c.	1.3	0.0	0.0	0.0
	d.	24.1	24.7	30.0	23.7
	e.	12.7	9.1	12.5	7.9
25.	a.	1.3	2.6	15.0	5.3
	b.	15.2	3.9	10.0	13.2
	c.	15.2	7.8	72.5	76.3
	d.	67.1	84.4	2.5	5.3
	e.	1.3	1.3	0.0	0.0
26.	a.	73.4	88.3	75.0	86.8
	b.	0.0	1.3	0.0	2.6
	c.	5.1	1.3	7.5	2.6
	d.	5.1	1.3	2.5	7.9
	e.	16.5	7.8	15.0	0.0
27.	a.	54.4	57.1	47.5	57.9
	b.	19.0	15.6	22.5	18.4
	c.	3.8	7.8	5.0	13.2
	d.	7.6	5.2	10.0	0.0
	e.	15.2	14.3	15.0	10.5
28.	a.	21.5	13.0	12.5	7.9
	b.	20.3	9.1	15.0	7.9
	c.	26.6	33.8	37.5	44.7
	d.	7.6	6.5	7.5	5.3
	e.	24.1	37.7	27.5	34.2

Continued on next page

TABLE M

(Continued)

		TREATMENT GROUP N = 80		COMPARISON GROUP N = 39	
		PRE-TEST Adjusted Frequency (%)	POST-TEST Adjusted Frequency (%)	PRE-TEST Adjusted Frequency (%)	POST-TEST Adjusted Frequency (%)
29.	a.	41.8	27.3	42.5	28.9
	b.	2.5	2.6	7.5	2.6
	c.	7.6	1.3	2.5	2.6
	d.	32.9	63.6	40.0	65.8
	e.	15.2	5.2	7.5	0.0
30.	a.	7.6	3.1	2.5	0.0
	b.	6.3	6.2	2.5	2.6
	c.	20.3	23.1	17.5	13.2
	d.	30.4	46.2	62.5	76.3
	e.	35.4	21.5	15.0	7.9
31.	a.	5.1	6.6	10.0	2.6
	b.	1.3	3.9	2.5	0.0
	c.	9.0	7.9	2.5	7.9
	d.	53.8	59.2	62.5	71.1
	e.	30.8	22.4	22.5	18.4
32.	a.	20.8	48.1	10.0	52.6
	b.	24.4	28.6	35.0	26.3
	c.	0.0	0.0	7.5	2.6
	d.	24.4	18.2	27.5	18.4
	e.	30.8	5.2	20.0	0.0
33.	a.	2.6	2.6	10.3	5.3
	b.	67.9	67.1	48.7	65.8
	c.	6.4	9.2	7.7	13.2
	d.	9.0	9.2	17.9	13.2
	e.	14.1	11.8	15.4	2.6
34.	a.	0.0	2.6	7.5	2.6
	b.	62.3	23.4	55.0	42.1
	c.	5.2	1.3	7.5	7.3
	d.	22.1	62.3	25.0	39.5
	e.	10.4	10.4	5.0	15.8
35.	a.	10.4	0.0	5.0	2.6
	b.	33.8	70.1	27.5	68.4
	c.	19.5	10.4	30.0	5.3
	d.	15.6	14.3	25.0	13.2
	e.	20.8	5.2	12.5	10.5
36.	a.	56.0	84.4	61.5	81.6
	b.	5.3	0.0	2.6	2.6
	c.	22.7	5.2	17.9	10.5
	d.	6.7	7.8	7.7	2.6
	e.	9.3	2.6	10.3	2.6

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TABLE M

(Continued)

		TREATMENT GROUP N = 80		COMPARISON GROUP N = 39	
		PRE-TEST Adjusted Frequency (%)	POST-TEST Adjusted Frequency (%)	PRE-TEST Adjusted Frequency (%)	POST-TEST Adjusted Frequency (%)
37.	a.	0.0	0.0	2.5	2.6
	b.	14.5	2.6	20.0	21.1
	c.	68.4	80.5	62.5	68.4
	d.	13.2	16.9	15.0	7.9
	e.	3.9	0.0	0.0	0.0
38.	a.	5.2	2.6	12.5	2.6
	b.	13.0	0.0	10.0	7.9
	c.	11.7	3.9	15.0	5.3
	d.	54.5	89.6	50.0	81.6
	e.	15.6	3.9	12.5	2.6
39.	a.	5.2	2.6	2.5	0.0
	b.	20.8	9.1	7.5	13.2
	c.	6.5	0.0	2.5	0.0
	d.	63.6	87.0	87.5	86.8
	e.	3.9	1.3	0.0	0.0
40.	a.	28.6	24.7	37.5	31.6
	b.	18.2	3.9	12.5	7.9
	c.	23.4	53.2	32.5	52.6
	d.	3.9	2.6	5.0	0.0
	e.	26.0	15.6	12.5	7.9
41.	a.	35.1	1.3	25.0	7.9
	b.	39.0	81.8	57.5	89.5
	c.	15.6	9.1	10.0	0.0
	d.	7.8	3.9	2.5	2.6
	e.	2.6	3.9	5.0	0.0
42.	a.	16.9	10.4	12.5	10.5
	b.	13.9	5.2	15.0	2.6
	c.	5.2	0.0	5.0	0.0
	d.	45.5	2.6	62.5	76.3
	e.	19.5	0.0	5.0	10.5
43.	a.	32.5	15.6	32.5	29.7
	b.	3.9	1.3	2.5	2.7
	c.	53.2	83.1	60.0	62.2
	d.	1.3	0.0	0.0	0.0
	e.	9.0	0.0	5.0	5.4
44.	a.	48.0	51.4	42.5	65.6
	b.	10.7	19.4	32.5	18.8
	c.	12.0	6.9	12.5	6.3
	d.	4.0	2.8	2.5	0.0
	e.	25.3	19.4	10.5	9.4

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TABLE M

(Continued)

QUESTION		TREATMENT GROUP N = 80 PRE-TEST Adjusted Frequency (%)	TREATMENT GROUP N = 80 POST-TEST Adjusted Frequency (%)	COMPARISON GROUP N = 39 PRE-TEST Adjusted Frequency (%)	COMPARISON GROUP N = 39 POST-TEST Adjusted Frequency (%)
45.	a.	19.7	4.4	20.5	3.6
	b.	30.3	51.5	46.2	71.4
	c.	10.6	5.9	10.3	3.6
	d.	16.7	13.2	10.3	3.6
	e.	22.7	25.0	12.8	17.9
46.	a.	20.0	8.6	7.7	7.1
	b.	18.5	60.0	23.1	64.3
	c.	3.1	8.6	7.1	0.0
	d.	12.3	12.9	15.4	3.6
	e.	46.2	10.0	46.2	25.0
COMPUTER PROGRAMMING					
1.	a.	41.2	48.0	50.0	37.5
	b.	5.9	8.0	12.5	37.5
	c.	23.5	30.7	25.0	12.5
	d.	5.9	4.0	0.0	12.5
	e.	23.5	9.3	12.5	0.0
2.	a.	0.0	9.3	14.3	0.0
	b.	22.2	17.3	14.3	0.0
	c.	27.8	29.3	14.3	37.5
	d.	22.2	38.7	42.9	37.5
	e.	27.8	5.3	14.3	25.0
3.	a.	11.1	6.8	25.0	0.0
	b.	38.9	19.2	12.5	9.8
	c.	11.1	50.7	25.0	9.8
	d.	38.9	6.8	12.5	0.0
	e.	0.0	16.4	25.0	80.5

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